CONTROLLING DATA TRANSMISSION INVOLVING A WIRELESS TELEPHONE

The present application is a continuation in part of, and claims priority in, U.S. Patent Application Serial No. 09/507,175 filed February 18, 2000, the entire disclosure of which is incorporated by reference herein.

FIELD OF THE INVENTION

The present invention relates to wireless communications systems. In particular, the present invention relates to a method and apparatus for providing a wireless communications channel to devices or applications located in a vehicle through any communication device capable of wireless communications.

BACKGROUND OF THE INVENTION

Wireless telephones, including cellular telephones, have become increasingly popular as a means for persons to remain in telephone, data and messaging contact with others, even when away from their home or office. In particular, wireless telephones allow persons traveling in vehicles to place and receive telephone calls, data and messages even while moving at high rates of speed. As wireless telephone technology has advanced, the telephones themselves have become smaller and smaller and more feature rich. In addition, and in particular with the implementation of various digital technologies, the stand-by and talk times provided by battery operated telephones have increased. The decrease in telephone size, the increase in features and the improvements in the battery life of wireless telephones have made the battery-operated wireless telephone an increasingly common communication device.

However, the small size and battery operated configuration of many wireless telephones can be disadvantageous when such telephones are used in automobiles. In particular, the small size of such telephones can make dialing and other operations difficult. In addition, even with advanced battery compositions and power-saving strategies, the batteries of wireless telephones eventually need to be recharged. Furthermore, when used to transmit data, a wireless telephone can typically be operatively connected to only one device or application at a time.

In order to address some of the disadvantages associated with the use of portable wireless telephones in vehicles, various "car kits" are known. At a most basic level, these car kits provide an interconnection between the telephone and the electrical system of the vehicle. These simple systems therefore allow the telephone to be powered by the electrical system of the car, and also to charge the telephone's battery. Other "car kits" provide a cradle fixed to the interior of the vehicle for holding the telephone, and require that the telephone be lifted from the cradle for use. Other simple "car kits" combine the interconnection to the vehicle's electrical system and the cradle for holding the telephone in a single device. However, these basic systems require that the user of the telephone remove at least one hand from the vehicle's controls in order to operate the telephone, and that the user hold the telephone to his or her face during calls.

At a next level, some conventional "car kits" provide basic speaker phone functions. These systems provide a microphone and speaker, external to the telephone, and adapted for use at a distance from the user. Therefore, with such a system, a

telephone call could be conducted without requiring that the telephone be held to the face of the user. In order to provide a speaker phone capability, the device must generally interface with proprietary electrical contacts provided on the exterior of the telephone. Generally, telephone manufacturers provide electrical contacts for supplying power and for the input and output of audio signals on the exterior of the telephone. Additionally, various contacts for access to and the provision of telephone control signals may also be provided. Through these contacts, it is possible to control various functions of the telephone.

However, adaptors for physically securing the telephone to the interior of the automobile, and for electrically interconnecting the telephone to the automobile and to processors for providing desired functionalities can be expensive. In particular, the cost of providing a hands-free control system in a vehicle to accommodate a number of different wireless telephones can be cost prohibitive because the physical and electrical characteristics of telephones vary by manufacturer and by model.

In addition, conventional adaptors do not provide a way to connect multiple devices or applications to a wireless telephone such that the devices or applications may transfer data over a communications channel established by the wireless telephone. Furthermore, conventional adaptors do not allow for the simultaneous use of a communications channel established using a wireless telephone. In addition, conventional adaptors do not provide a common interface that can be used to physically attach devices or applications to a variety of wireless telephones having different interfaces. In

particular, existing adaptors do not provide a control interface that allows a device to control aspects of the operation of a wireless telephone using a standardized interface.

In order to enable wireless communications devices to be used in connection with the transmission of data, a device must typically connect to a proprietary interface provided on the wireless telephone. Alternatively or in addition, the device or application interconnected to the telephone must be able to control the telephone to establish the required wireless connection. Often, the commands required to operate the telephone are unique to the particular telephone or brand of telephone to which the device or application is interconnected. Although standards concerning the commands that may be used to direct a telephone to establish a data link have been established, those standards have not been adopted by all telephone manufacturers. Therefore, a device must have the proper physical connector required to interface with the telephone, and the device or application running on the device must be able to communicate using the protocol and the command set required by the wireless telephone (*i.e.* using the communication interface of the telephone).

For the above-stated reasons, it would be advantageous to provide an improved method and apparatus for providing a hands-free wireless communications device in a vehicle. In addition, it would be advantageous to provide a method and an apparatus that allow for a single docking station containing many of the components necessary to provide the desired functions that can be used with any of a plurality of pocket devices provided for interfacing with supported telephones. Furthermore, it would be advantageous to

provide a method and an apparatus that allows multiple devices or applications to interconnect to a wireless communications device and to communicate over a channel established by the wireless communications device at substantially the same time. It would also be advantageous to provide a method and an apparatus that allow a device to interconnect to a wireless telephone using a common interface, and to control the establishment of a communications channel using a standardized command set and protocol, without requiring the device to know how to control a particular wireless communications device. In addition, it would be advantageous to provide such a method and apparatus that can be implemented at an acceptable cost, that allow the user to easily and economically expand the provided functions, and that are reliable in operation.

SUMMARY OF THE INVENTION

In accordance with the present invention, a system for allowing devices and applications to communicate over a channel established by a wireless communications device is provided. The disclosed system generally includes a docking station, a pocket or adaptor and a wireless communications device. In general, the pocket is adapted to interface a particular wireless communications device or family of devices to a common docking station that may be capable of functioning with different pocket designs. The pocket and the docking station interact with the wireless communications device to economically provide for the interconnection of devices or applications to the wireless communications device using a standardized interface.

A pocket in accordance with the present invention is adapted to be mechanically and electrically interconnected to a particular communications device or set of devices. Mechanical features of the pocket include surface features to allow the communications device to be held by the pocket and electrical connectors for mating with various electrical connectors provided with the communications device. Provisions for the electrical interconnection of the pocket and the communications device include, in addition to the above-mentioned electrical connectors, signal lines and processing capabilities. Accordingly, the pocket may provide for the passage of, *e.g.*, radio frequency signals and digital data signals through the pocket without processing by the pocket. In addition, the pocket may include a processor for converting telephone control and other signals between the proprietary interface of the communications device and the application programming interface (API) of the system, allowing the pocket to pass telephone control and other information between the pocket processor and the docking station using a pocket docking station communications bus. Because the physical and electrical characteristics of communications devices such as wireless telephones varies, a pocket may be provided for each unique combination of physical and electrical characteristics found among supported communications devices.

The pocket is also adapted for mechanical and electrical interconnection to the docking station. The mechanical interconnection may include the provision of a common mounting system for joining the pocket and docking station together, including electrical contacts, or simply electrical contacts where the docking station is remotely located from

the pocket. Electrical interconnections between the pocket and docking station may also be according to a common standard, and may include signal paths for various signals. At least some of the signals present between the pocket and the docking station may be formatted according to the above-mentioned API. According to an embodiment of the present invention, the docking station may be interconnected to any of a plurality of pockets.

The docking station may contain a digital signal processor, Power PC, RISC or other processor for sending and receiving commands transmitted over the pocket docking station communications bus, and for controlling other functions. For instance, the digital signal processor of the docking station may perform various signal processing functions to remove noise, as well as acoustic echos and line echos, from audio signals passed between the telephone and a speaker, as well as from a microphone to facilitate hands-free communications. The digital signal processor may also serve to interpret voice commands issued by a user concerning control of the system. Other potential functions of the docking station digital signal processor include wireless data processing or forwarding, the storage of voice memoranda, text to speech functions, and for interfacing the system to other communication devices, such as personal information managers (PIMs), GPS receivers, vehicle communications busses, Bluetooth devices, and other devices. In accordance with one embodiment of the present invention, multiple processors, each adapted to perform particular tasks, may be provided as part of the docking station.

The docking station may also provide a standard interface for interconnecting external devices to the system. For example, the docking station may provide a network interface, such as an Ethernet network interface. External devices, such as laptop computers, personal digital assistants (PDA) and other devices capable of communicating over such a network may then be interconnected to the system. According to one embodiment, the standard interface is provided as part of a data daughter board that is itself interconnected to the docking station. In addition, the docking station may provide for a standard command set to allow the external devices or applications running on the external devices to control aspects of the wireless communications device's operation. According to another embodiment of the present invention, a cable or interconnection between an external device and the docking station may be provided with componentry to reformat commands as required. Accordingly, the external devices are not required to issue commands formatted according to the proprietary communications interface of the particular wireless communications device associated with the system. The provided command set may be part of the API of the system.

According to one embodiment of the present invention, the pocket in part controls access by a user to the functional capabilities of the system. Accordingly, a pocket may interconnect a communications device to a docking station in such a way that power may be supplied to the device, and audio communications may be passed to and from that device. However, the pocket may not allow for the recording of voice memoranda, even though the docking station may contain the processing, control and storage components

necessary to provide that functionality. A second pocket may enable the user to access the voice memorandum recording capability of the docking station. Yet another, third pocket may additionally provide for the storage of voice memoranda in the pocket itself. Accordingly, this third pocket may allow a user to easily take recorded memoranda to, *e.g.*, a docking station type device located in the user's home or office for playback of the memoranda. Still another pocket, used in combination with a suitable docking station, may enable a text to speech functionality. In this way, the system of the present invention allows a single model of docking station to optionally support a wide variety of communications devices and to provide a wide variety of functions. Therefore, the communications devices supported and the functional capabilities of the system can, at least in part, be determined by the pocket used as part of the system.

The system of the present invention allows a user to change, for example, his or her wireless telephone, while continuing to use the system, even where the physical and electrical characteristics of the new wireless telephone are different from the old, by purchasing a new pocket, while continuing to use the original docking station. In general, a user may gain access to additional capabilities by substituting a pocket enabling or providing a first set of capabilities for a pocket that enables or provides those additional capabilities. In this way, the system of the present invention enables a user to change his or her communications device without having to replace the docking station, and to upgrade the capabilities of the system by obtaining a pocket having the desired additional capabilities.

According to another embodiment of the system of the present invention, various models of docking stations may be available, allowing a user to determine the capabilities of the system at least in part by the docking station chosen. Accordingly certain docking stations may have less capabilities and be offered at a lower price than certain other docking stations that are more recent or that are more expensive but that offer expanded capabilities. Different models of docking stations may also be offered to provide or support new features. The various models of docking stations are preferably compatible, at least in part, with any pocket.

According to one embodiment of the system of the present invention, the system can provide a text to speech function to, for example, provide an audio output of textual data received by the communications device. This capability may be built into the docking station, or may be added to the docking station by the addition of a daughter board containing additional componentry to support the text to speech function.

The system is also capable of handling communications involving separately identifiable vehicle subsystems using processing or server functionalities of the docking station and/or associated daughter board. The vehicle having the vehicle subsystems has a unique IP address to allow communications over the Internet. In communications with the vehicle subsystem, the vehicle IP address is utilized outside the vehicle, while inside the vehicle the communication can be mapped to, or otherwise associated with, the particular vehicle subsystem involved with the communication.

Additional advantages of the present invention will become readily apparent from the following discussion, particularly when taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A illustrates a system for providing wireless communications in a vehicle according to an embodiment of the present invention;

Fig. 1B illustrates a pocket according to another embodiment of the present invention;

Fig. 2 is a rear perspective view of a pocket according to an embodiment of the present invention;

Fig. 3 is a schematic illustration of a system for providing wireless communications in a vehicle according to an embodiment of the present invention;

Fig. 4A is a schematic representation of a system for providing wireless communications in a vehicle according to an embodiment of the present invention;

Fig. 4B is a schematic representation of a system for providing wireless communications in a vehicle according to another embodiment of the present invention;

Fig. 5 is a schematic illustration of a pocket according to an embodiment of the present invention;

Fig. 6 illustrates functional compatibilities between components of a system for providing wireless communications in a vehicle according to an embodiment of the present invention;

Fig. 7 illustrates the pocket communications state machine according to an embodiment of the present invention;

Fig. 8 illustrates the architecture of the docking station software according to an embodiment of the present invention;

Fig. 9 illustrates a typical communications scenario according to an embodiment of the present invention;

Fig. 10 illustrates a pocket worst case communications scenario;

Fig. 11 illustrates a docking station worst case communications scenario;

Fig. 12 is a block diagram depicting a system in accordance with the present invention interconnecting a plurality of applications to a server;

Fig. 13 depicts a data daughter board in accordance with an embodiment of the present invention;

Fig. 14 is a flow chart illustrating aspects of the operation of a system in accordance with the present invention in response to the receipt of a data packet from an application;

Fig. 15 is a flow chart illustrating additional aspects of the operation of a system in accordance with the present invention in response to the receipt of a data packet from an application; and

Fig. 16 is a flow chart illustrating aspects of the operation of a system in accordance with the present invention in the context of an example.

DETAILED DESCRIPTION

With reference to **Fig. 1A**, an embodiment of a system **100** for providing wireless communications in a vehicle is depicted. The system **100** generally includes any communications device capable of wireless communications (*e.g.*, a wireless telephone) **102**, a first holding assembly or pocket **104**, also referred to herein as adaptor **104**, and a docking station or an interface module (IM) **106**. For purposes of the present disclosure, the terms holding assembly, pocket and adaptor shall be treated as being synonymous. The telephone **102** may have, or be compatible or otherwise operatively associated with, any current or future wireless technology, including, but not limited to, analog technologies such as the Advanced Mobile Phone System (AMPS), or digital systems such as a code division multiple access (CDMA) system, a time division multiple access (TDMA) system such as the Global System for Mobile Communications (GSM), a third generation (3G) system, such as wide band CDMA (W-CDMA), multicarrier CDMA, Time Division Duplex CDMA, or 3G EDGE (Enhanced Data Rates for GSM Evolution), or a combination of these and other air link technologies, such as the Bluetooth standard. In addition, the telephone **102** can be a wireless communications device other than a wireless telephone, such as a satellite telephone, a radio, a software defined radio, a personal digital assistant, with or without wireless telephone capability or other service. In general, the telephone **102** is designed by its manufacturer to operate on batteries **107** and to be small in size to allow for easy portability. In addition, the telephone **102**

generally features a built-in speaker **108** and microphone **110** to provide for the input and output respectively of audio signals when the telephone **102** is held to the head of the user.

The telephone **102** includes a keypad **112** to allow the user to dial numbers and to access the internal capabilities of the telephone **102**, such as stored directories of telephone numbers, voice mail, paging or other features that may be provided by the telephone **102**. User-defined functions such as directories of the telephone numbers may be stored in internal memory provided in the telephone **102**. In addition, a typical telephone **102** includes a visual display **114** for displaying the number to be called or other information, such as the contents of a memory location or the number from which an incoming call originates. The telephone **102** will generally include baseband frequency amplifiers associated with the speaker **108** and the microphone **110**. The telephone **102** also includes a radio frequency section for transmitting and receiving signals at the telephone's **102** operating frequencies. An electrical connector **116** is generally provided to allow the telephone **102** to be electrically connected to external devices. For example, the telephone **102** may be connected to an external power supply through the electrical connector **116**. In addition, the connector **116** generally includes contacts for the transmission of control and data signals to the telephone **102**. In some telephones **102**, provision may also be made for the interconnection of a coaxial radio frequency cable to a radio frequency port **118**, allowing the telephone **102** to utilize an external antenna.

The pocket **104** generally includes a recess **120** shaped to receive the exterior of the telephone **102**. The recess **120** may include surface features **122**, such as friction pads or protrusions shaped to mate with receiving features on the telephone **102**, to mechanically interconnect the telephone **102** and the pocket **104**. The pocket **104** is also provided with an electrical connector **124** that mates with the electrical connector **116** of the telephone **102** when the telephone **102** is properly positioned within the recess **120** of the pocket **104**. The pocket **104** may also be provided with a coaxial connector **126** for interconnection with a coaxial connector **118** on the telephone **102**. Therefore, the pocket **104** is electrically connected to the telephone **102** through the electrical connections **116** and **124** and the coaxial connectors **118** and **126**. The pocket **104** may also be provided with componentry to establish a wireless link with the telephone **102**.

The docking station **106** includes locating protuberances **128** for receiving locating apertures **130** located on the back side of the pocket **104** (see **Fig. 2**). The locating protuberances **128**, together with latch tabs **132** cooperate with the locating apertures **130** to mechanically interconnect the pocket **104** to the docking station **106**. The docking station **106** also features an electrical connector **134** that mates with an electrical connector **136** located on the back of the pocket **104** (see **Fig. 2**). The docking station **106** additionally includes a coaxial connector **138** for connection to a cooperating coaxial connector **140** located on the back of the pocket **104** (see **Fig. 2**). The docking station

106 may also be provided with componentry to establish a wireless link with the telephone **102** or the pocket **104**.

In the system of the present invention, the telephone **102** generally serves to transmit and receive radio frequency signals, and to demodulate and modulate those signals to and from the baseband frequencies (*e.g.*, the audible frequencies or digital data communication frequencies). The telephone **102** then provides the baseband frequencies to the pocket **104** through the mating of the electrical connectors **116** and **124**. Alternatively, the telephone **102** may provide the baseband frequencies over a wireless link. The pocket **104** also holds the telephone **102** securely in place. The electrical connector **136** and/or wireless link, in cooperation with the electrical connector **134** on the docking station **106** and/or wireless link provided by the docking station **106** or the pocket **104**, completes the electrical interconnection of the telephone **102** to the docking station **106** either directly or through the pocket **104**, and in turn to the vehicle. The docking station **106** also serves to mechanically interconnect the pocket **104**, and in turn the telephone **102**, to the vehicle, as the docking station **106** is generally rigidly affixed to the vehicle. The radio frequency connectors **118**, **126**, **138**, and **140** also cooperate to carry radio frequency signals from the telephone **102** to an antenna mounted on the exterior of the vehicle. Therefore, in summary, the pocket **104** generally serves to mechanically and electrically interconnect the telephone **102** to the docking station **106** and in turn to the vehicle.

Referring now to **Fig. 1B**, an alternative embodiment of the pocket **104** of the present invention is illustrated. According to the embodiment of the pocket **104** illustrated in **Fig. 1B**, a plurality of control buttons **142** are provided. The control buttons **142** allow the user to access certain advanced features of the pocket **104** provided with select embodiments of the system **100** and in particular of the pocket **104**. These advanced functions will be discussed in detail below.

Referring now to **Fig. 3**, the major internal components of the telephone **102**, the pocket **104**, and the docking station **106**, as well as relevant components integral to the automobile or vehicle **302** are illustrated. As described generally above, the telephone **102** may provide various electronic signal paths. Therefore, the telephone **102** may accept power from an external source through a power supply line **303.** The transmission of analog audio signals from the telephone **102** to the pocket **104** may be made through the analog audio output line **304**, and analog audio signals may be transmitted from the pocket **104** to the telephone **102** through the analog audio input signal line **306**. The telephone **102** may also be provided with one or more signal lines **308** for receiving and transmitting digital data or digital audio signals. Other signal lines that may be provided include a clock signal line **310**, a frame synch signal line **312**, and telephone control signal bus **314**. Telephone control signals passed over the telephone control signal bus **314** may include signals to turn the telephone **102** on or off; to indicate that data is ready to be sent from the telephone, or that the telephone is ready to receive data; to request power or a

change in power; to lock and unlock the telephone; to mute the telephone; to indicate an incoming call; to change the telephone language; to auto answer; to convey or request call timer information, current call status, call restriction data, telephone display data, calling number data, serial message data, cellular system information, or telephone system information; to request or control the telephone volume; to recall or write telephone numbers or other information from the telephone's memory; to simulate a telephone keypress; to dial a number; caller identification data; and to initiate the send command or the end command. All of the various electrical lines **303, 304, 306, 308, 310, 312** and **314** may be a part of the electrical connector **116** on the exterior of the telephone **102**. The telephone **102** may also be provided with a radio frequency signal line **316** in the form of the coaxial connector **118**.

As described above, the pocket **104** is provided with an electrical connector **124** for electrically interconnecting the pocket **104** to the telephone **102**. Some of the electrical signals passing through the connector **124** are simply carried through the pocket **104** to the electrical connector **136**, and thereby are passed on to the docking station **106** directly. Other of the signals are manipulated or processed within the pocket **104**. For example, the analog audio output signal **304** is amplified in the pocket **104** by an analog audio amplifier **318**. In addition, a microprocessor **320** processes telephone control signals on the telephone control signal bus **314** that are passed between the telephone **102** and the pocket **104**, and communication on the pocket docking station bus **322** passed

between the pocket **104** and the docking station **106**. Pocket memory **324** may be associated with the microprocessor **320**. The pocket memory **324** may be any addressable storage space, such as ROM, RAM, EEPROM, flash memory, or a combination of memory types. All or a portion of the memory **324** may be removable from the pocket **104**. The pocket **104** also includes a ground signal **326** for signaling to the docking station **106** through electrical connectors **134** and **136** the presence or absence of the pocket **104**.

The docking station **106** includes processing hardware and software including at least one microprocessor and/or a digital signal processor **328**, a programmable power supply **330**, a DC to DC power converter **332**, a near-end coder/decoder (CODEC) **334**, a far-end CODEC **336**, one or more universal asynchronous receivers/transmitters **338** (UART), and docking station memory **340**. The docking station memory **340** may be any addressable storage space, such as ROM, RAM, EEPROM, flash memory or a combination of memory types. All or a portion of the memory **340** may be removable from the docking station **106**. The docking station **106** also includes a multiplexer **342**, an analog audio amplifier **344**, and ground lines **326** and **346** for establishing a common ground between the pocket **104** and the docking station **106**. The docking station **106** may additionally include an interface **348** for interconnecting the docking station **106** to various external subsystems **378**. The interface **348** may be integral to the docking station **106**. Alternatively, the interface **348** may conveniently be mounted to a daughter board

380, also referred to herein as data daughter board (DDB) **380,** to facilitate expanding the capabilities of the docking station **106**. The daughter board **380** may also have a microprocessor including server capabilities. The daughter board **380** may be interconnected to the digital signal processor **328** by a serial or parallel communications channel. According to a further embodiment, instead of such a daughter board **380**, all of the interface's **348** capabilities and the docking station components and their functionalities could be integrated on a single chip. In general, the provision of the interface **348** allows the docking station **106** to serve as a communications hub for various external subsystems **378**. These external subsystems **378** may include personal computers, auto PCs, Global Positioning System (GPS) units, Personal Digital Assistants (PDA); devices for the storage of digital audio for playback through the automobile's stereo, such as devices storing music in the MP3 format; the data network or communications bus of vehicles, such as a controller area network (CAN), other data network or communications busses, visual displays; devices using the Bluetooth communications protocol or some other communications protocol; or other electronic systems. In connection with possible implementation of Bluetooth technology, such may be integrated with the docking station **106**, as well as being incorporated with the pocket **104.** In such a case, the Bluetooth technology need not be part of the wireless telephone **102** or other wireless communication device. According to this embodiment, the pocket **104** and the docking station **106** could cooperatively function to provide services for associated Bluetooth

devices. In this configuration, the number of signal conducting wires is substantially reduced. However, one or more wires may be necessary or appropriate for providing charging functions and/or providing an external antenna connection.

With respect to facilitating communications with the vehicle **302** having the wireless communications device **102**, particularly communications to vehicle subsystems **378** using the Internet, the vehicle subsystems **378** can be configured to be separately accessible. These individualized communications are achieved, preferably not by assigning separate Internet protocol (IP) addresses to each of the vehicle subsystems **378**, but by incorporating an address-related mapping technique. In accordance with the preferred embodiment, the particular vehicle **302** has only one IP address, or at least the number of IP addresses associated with the vehicle **302** and vehicle subsystems **378** is less than the total number of vehicle subsystems **378**. In the case in which the vehicle **302** has only one IP address, it is necessary to be able to direct the received communication to the desired vehicle subsystem **378**. This can be accomplished by assigning or correlating ports or other identifiers to each of the vehicle subsystems **378** for which there is interest in allowing such communication. When a communication is received for a designated vehicle subsystem **378**, the docking station **106** and/or associated daughter board **380** functions to map the contents of the received communication to the port or other identifier associated with a particular vehicle subsystem **378** that is to be the recipient of this communication. In a preferred embodiment in which it is desirable to communicate with a number or a fleet

of vehicles **302** from a common site outside the vehicle **302**, each of the vehicles **302** in the fleet would be assigned a separate IP address. However, the identifiers or ports associated with each of the vehicle subsystems **378** in this fleet would have the same or corresponding port or other identifier. For example, vehicle subsystem 1 in vehicle 1 would have the same port number or other identifier as vehicle subsystem 1 in vehicle 2, although the IP addresses of vehicle 1 and vehicle 2 would be different. This configuration is highly beneficial in managing fleet vehicles **302**, particularly sending/receiving information relative to each of a number of vehicle subsystems **378** in a large number of vehicles. Relatedly, such configuration makes it easier to identify and locate each of the vehicle subsystems **378** in a fleet since the same vehicle subsystem **378** in one vehicle has the same identifier as an identical vehicle subsystem **378** in another vehicle in the fleet.

With regard to sending a first communication to a first external subsystem **378** located in a first vehicle **302**, a communication can be prepared at a site remote from the vehicle **302**. The communication packet includes an IP address for the first vehicle. The communication packet also includes address-related (*e.g.*, port) information or other identifying information associated with the first external subsystem **378** that is to receive this first communication packet. The first communication packet is transmitted over the Internet to the first vehicle having the IP address in the communication packet. This communication packet is then received by the wireless telephone or other wireless

communication device **102**. Subsequently, a determination is made regarding the ultimate location or external subsystem **378** recipient of the first communication packet. This determination might be made by processing hardware and software in the docking station **106** and/or other processing hardware/software including possibly a server on the daughter board **380**. The docking station **106** may be provided with a network interface, such as an Ethernet Network interface, for providing data packets to recipient external subsystems or devices **378** and applications running on those devices **378**. The network interface may conveniently be provided as part of a data daughter board **380**. As part of the processing or determination procedures, mapping or other correlation can be provided between the information in the first communication packet related to identifying the particular external subsystem **378** that is to receive the communication packet and a port or other identifier associated with this external subsystem **378**. After the mapping is completed, the communication packet can be directed to the determined first external subsystem **378**, which was designated as the recipient of this communication. As can be appreciated, in the case in which the same communication is to be sent to the same vehicle subsystem **378** located in a number of vehicles **302** in a fleet, only the IP address for each vehicle **302** need be changed to its dedicated vehicle IP address. As can be further appreciated, when it is desirable to send a communication to a second vehicle subsystem **378** located in the first vehicle **302**, either at the same time or at different times, the same IP address associated with that first vehicle **302** can be utilized, while the mapping

function to enable the communication to be received by the second vehicle subsystem **378** can be handled within the vehicle **302**.

Similarly, in communicating from the vehicle **302** to a site outside the vehicle, such as a common site associated with sending/receiving communications to/from a fleet of vehicles **302**, and involving the transmission of data or other information from one or more vehicle subsystems **378** in the vehicle, the network address translation (NAT) can also be accomplished. In particular, the server or other processing hardware/software conducts an address translation by which the vehicle IP address is provided before the communication is sent over the Internet. Such a communication could also include identifying information that identifies the accompanying data as emanating from the particular vehicle subsystem. Consequently, the communication to the site outside the vehicle is accomplished using a single IP address, regardless of which vehicle subsystem might be providing data to the site over the Internet.

Additionally, the docking station **106** is provided with various signal paths for interconnecting the docking station **106** to the pocket **104** and the vehicle or automobile **302**. Signal paths between the pocket **104** and the docking station **106** include the analog audio input signal path **306** and the amplified analog audio output signal path **350**. Digital data signal paths **308** and clock **310** and frame synch **312** signal paths may also be provided between the pocket **104** and the docking station **106**. The pocket docking station communications bus **322** also runs between the pocket **104** and the docking station

106. The bus **322** may be a serial bus or any other appropriate bus. Various power lines may also run between the pocket **104** and the docking station **106**, such as the telephone power supply line **303** and the pocket power line **352**. The docking station power enable line **354** connects the microprocessor **320** of the pocket **104** to the DC to DC power convertor **332** in the docking station **106**. The ground **326** and pocket sense **346** lines also pass between the pocket **104** and the docking station **106**. Radio frequency signals are passed through the docking station **106** from the pocket **104** to an antenna **356** mounted on the automobile **302** over the radio frequency signal line **316**. Additionally, a signal indicating the position of the automobile's **302** ignition switch **358** is passed through the docking station **106** to the microprocessor **320** of the pocket through the ignition signal line **360**.

Signal paths between the docking station **106** and the automobile **302** include the radio frequency signal line **316**, which passes from the telephone **102**, through pocket **104** and the docking station **106** to the antenna **356** on the automobile **302**. In addition, near-end audio input **370** and audio output **372** lines connect the near-end CODEC **334** to the microphone **368** and the speaker **366**, respectively. The audio output line **372** passes through an analog audio amplifier **344** before continuing on to the speaker **366**. The mute line **362** connects the docking station microprocessor **328** to the entertainment system **373** of the automobile **302**. The main power line **374** connects the DC to DC power convertor **332** of the docking station **106** to the electrical power supply **364** of the automobile **302**.

The ignition signal line **360** passes through the docking station **106**, between the microprocessor **303** of the pocket **104** and the ignition switch **358** of the automobile **302**. Additionally, one or more custom interface signal lines **376** may connect the interface **348** of the docking station **106** to various other subsystems **378** located in the automobile **302**.

As a result of the above-mentioned signal paths, in addition to being mechanically interconnected to the automobile **302**, the docking station **106** is electrically connected to certain of the automobile's **302** components. Therefore, the docking station **106** may be interconnected to an antenna **356** provided on an exterior of the automobile **302**. Also, the docking station **106** is interconnected to the electrical power supply **364** of the automobile **302**, and may also be connected to the ignition switch **358** of the automobile **302** to signal operation of the system **100** when the automobile **302** is running. Speakers **366** located within the automobile **302** may conveniently be utilized by the system **100** to provide an audible signal from the telephone **102**. The speakers **366** may or may not be a part of the automobile's **302** audio entertainment system **373**. Also, the speakers **366** may be part of a headset worn by the user. For receiving audible signals (*e.g.*, the voice of a user), a microphone **368** may be located within the interior of the automobile **302**, and that signal processed by the docking station **106** and provided to the telephone **102** via the pocket **104**. The docking station **106** of the system **100** may also be interconnected to the audio system **373** of the automobile **302** to mute signals other than those transmitted from the telephone **102** to the speakers **366**.

Preferably, the system **100** is provided in a variety of models offering differing capabilities to suit the needs and budgets of individual users. These differing capabilities are provided by varying the functionality supported by the pocket **104** and/or the docking station **106**. Referring now to **Figs. 4A** and **4B**, embodiments of the system **100** having differing capabilities are illustrated schematically.

With reference now to **Fig. 4A**, a telephone **102**, pocket **104**, docking station **106**, and automobile **302** of an embodiment of the system **100** are illustrated schematically. With respect to the telephone **102**, the radio frequency **316**, power **303**, audio **304** and **306**, control **314**, and digital data signal lines **308** are illustrated. It is noted that, while the digital data path **308** is shown at the telephone **102**, it is not passed through the pocket **104** to the docking station **106**. This is because the embodiment of the pocket **104** illustrated in **Fig. 4A** does not support digital data signals **308**, and thus does not provide a digital data line.

The pocket **104** of the embodiment illustrated in **Fig. 4A** includes signal paths for the radio frequency **316** and power **303** signals. For at least the incoming analog audio signal, an amplifier **318** is provided. Telephone control data line **314** is interconnected to the microprocessor **320** located in the pocket **104**. Therefore, it can be seen that, in the embodiment shown in **Fig. 4A**, the pocket **104** provides interconnections to all of the telephone's **102** electrical inputs and outputs, except for those outputs for digital data or digital audio.

The pocket **104** of the embodiment shown in **Fig. 4A** amplifies audio signals provided from the telephone **102**, and includes a microprocessor **320** for providing an interface for control data **314** passed between the telephone **102** and the docking station **106**. As illustrated in **Fig. 4A**, a universal asynchronous receiver transmitter (UART) **402** may be associated with the microprocessor **320** for aiding the transmission of flow control data between the telephone **102** and the pocket **104**. In one embodiment, a single UART **402**, which is part of the microprocessor **320**, is provided on the pocket **104** side of the telephone control signal path established between the pocket **104** and the docking station **106**. Because a UART **338** is provided in the docking station **106,** no additional UART is necessary. By eliminating an additional UART, the cost of the pocket **104**, and in particular the cost of the microprocessor **320**, can be kept to a minimum. However, in certain applications, such as those in which the docking station **106** is located at a distance from the pocket **104**, it may be necessary to provide an additional line driver in the pocket **104**.

The docking station's **106** major components are shown in **Fig. 4A** as the docking station microprocessor **328**, the power supply **330**, the near-end **334** and far-end **336** CODECs, the UART **338**, and the docking station memory **340**. The docking station **106** is also illustrated as providing a signal path for the radio frequency signal **316**. The docking station microprocessor **328** provides a variety of advanced functions that will be described in greater detail below. The power supply **330** provides a constant voltage or a

constant current, according to the requirements of the particular telephone **102**, for powering the telephone **102** and charging the telephone's **102** battery **107**. The CODECs **334** and **336** provide for the conversion of analog audio signals to digital signals that can be processed by the docking station microprocessor **328**, and likewise convert digital audio signals emanating from the docking station microprocessor **328** into analog signals usable by the analog audio inputs of the telephone **102** or the speakers **366** of the automobile **302**. As described above with respect to the pocket **104**, the UART **338** of the docking station **106** facilitates the communication of telephone **102** control data between the pocket **104** and the docking station **106** across the pocket- docking station bus **322**. The docking station memory **340** allows voice memos or other data to be stored in digital form. In addition, the docking station memory **340** may be used to store word models and voice prompts used to support voice recognition features. As an additional function, the docking station memory **340** may be used to correct errors in the code resident in the docking station microprocessor **328**.

The automobile **302** is, in the embodiment illustrated in **Fig. 4A**, shown as being connected to the radio frequency **316**, power **374**, audio **370** and **372** and control **362** line. However, the data line **308** is not shown as being interconnected to the data line **308** of the telephone **102**. This is because the pocket **104** of the embodiment makes no provision for transmitting such data **308** to or from the telephone **102**.

Referring now to **Fig. 4B**, a telephone **102**, pocket **104**, docking station **106**, and automobile **302** of yet another embodiment of the system **100** are illustrated schematically. The system **100** illustrated in **Fig. 4B** includes all of the various signal lines and structures described above with respect to the embodiment illustrated in **Fig. 4A**. However, in addition, the embodiment illustrated in **Fig. 4B** includes a digital data line **308** from the telephone **102** through the pocket **104** to a second UART **402** located in the docking station **106**. The second UART **402** of the docking station **106** is connected to a third UART **404** in the docking station **106**. The interface signal line **376** runs between the third UART **404** of the docking station **106** and the automobile **302**. Thus, the embodiment of the system **100** illustrated in **Fig. 4B** provides a direct path for digital data or audio from the telephone **102** to the docking station **106**, including the docking station microprocessor **328**, and from the docking station **106** to the automobile **302**. The provision of these digital data lines **308** and **376** allows the system **100** to support additional features, as will be described in greater detail below.

Referring now to **Fig. 5**, an embodiment of the pocket **104** of the present invention is illustrated schematically. As shown in **Fig. 5**, the pocket **104** generally includes an electrical connector **124** for providing electrical connectivity between the pocket **104** and the telephone **102**. Additionally, a radio frequency connector **126** may be provided for the transmission of radio frequency signals across the pocket **104** to the docking station **106**. The radio frequency signal line **316** thus travels between the radio frequency connector

126 at the interface of the telephone **102** and the pocket **104**, and the radio frequency connector **140** at the interface of the pocket **104** and the docking station **106**. An electrical connector **136** provides other electrical connections between the pocket **104** and the docking station **106**. As discussed above, digital data lines **308** can be provided in the pocket **104** to pass digital data or digital audio signals directly from the telephone **102** to the docking station **106**, without manipulation by componentry within the pocket **104**. Other signal lines that are provided for transmission of signals across the pocket **104** without manipulation by the pocket **104** are the clock signal line **310** and the frame synch signal line **312**. Also, one or more power supply lines **303** transmit power from the docking station **106** directly to the telephone **102**.

As discussed above, an analog audio amplifier **318** receives analog audio signals from the telephone **102** over the analog audio analog output line **304**. The analog signals received at the amplifier **318** are then amplified a selected amount and passed to the docking station **106** over the amplified analog output line **350**. Also shown in **Fig. 5** is an analog audio input amplifier **502** which may be provided to selectively amplify analog audio signals from the docking station **106** before they are passed to the telephone **102** over analog audio input line **306**.

A voltage regulator **504** may be provided in the pocket **104** for providing the correct voltage level to power the microprocessor **320**. For example, the voltage regulator **504** may take a 5 volt signal supplied by the DC to DC power convertor **332** in

the docking station **106** over power line **352**, and produce a 3 volt output. The 3 volt output may then be supplied to the microprocessor **320** over regulated power supply line **506**.

The signals provided from the docking station **106** through the electrical connector **136** to the pocket **104** include communication signals transmitted over the pocket-docking station communication bus **322**. The communication bus **322** terminates in the microprocessor **320** at serial input/output pins **508**. As will be described in greater detail below, the communication signals received at the serial I/O pins **508** are decoded before being sent to the microprocessor UART **510** for transmission to the telephone **102** over the telephone control lines **314**. Other signal lines passing between the docking station **106** and the pocket **104** include a plurality of in-circuit programming signal lines **512**, which may be used to program or re-program the pocket microprocessor **320**. The ignition signal line **360** and mute line **362** are also provided. Additional I/O signal lines **514** may be provided between the microprocessor **320** and the telephone **102**. A pocket detect ground **326** for interconnection to the docking station **106** is also provided. Additionally, memory **324** may be provided in the pocket **104** for use in association with the microprocessor **320**. According to one embodiment of the pocket **104**, the microprocessor **320** includes inputs for receiving signals from buttons **142** (see **Fig. 1B**) on the exterior of the pocket **104**.

As mentioned above, the telephone **102** may generally be used to transmit and receive voice and data signals over an air link to a base station, such as a cell in a cellular phone system. Additionally, the telephone **102** will typically allow for the storage of indexed lists of telephone numbers to provide the user with a customized list or directory of telephone numbers. The telephone **102** is also provided with a speaker **108** and microphone **110** to allow the user to engage in conversations over the telephone **102** when the telephone **102** is held to the face of the user. A keypad **112** is typically used to enter numbers and initiate dialing, answer incoming calls, and to enter telephone directory information. A visual display **114** is also typically provided for displaying the number to be called, memory location entries, or other information. The telephone **102** may be powered by a battery **107** so that the telephone **102** is easily portable.

However, the telephone **102** is typically not provided with features allowing for easy hand held use in an automobile. For instance, placing a call typically requires the user to enter the number using the keypad **112**, or again using the keypad **112**, to select from an entry in a user-defined directory. Using the keypad requires that the user remove his or her eyes from the road to view the keypad **112** and the display **114**, and to remove a hand from the automobile's **302** controls to enter the number or select the desired option. This is, of course, disadvantageous where the user is driving the automobile **302**. Although some telephones **102** are available with built-in voice recognition features, they are "near talk" systems, and are not well suited for use in vehicle or other "far talk" environments.

Therefore, it is desirable to provide a system to allow the reliable hands-free operation of the telephone **102**.

As can be appreciated, the telephone **102** may be produced by any one of a number of manufacturers, who each may produce a variety of different models. Accordingly, the physical shape of the telephone **102**, as well as the physical configuration of the electrical connector **116** and the particular signal lines provided by the electrical connector **116** may vary greatly. Additionally, the communications protocol recognized by the telephone **102** is generally proprietary to the manufacturer of the telephone **102** and may vary among telephone **102** models produced by a single manufacturer.

In order to accommodate the variety of physical, electrical, and communications protocol variations among telephones **102**, the present invention provides a plurality of different pocket **104** configurations. Thus, a pocket **104** may be provided to mate with the various physical configurations of different telephones **102**. Accordingly, the recess **120** and surface features **122** are generally determined by the physical characteristics of the telephone **102** meant to be accommodated by the particular pocket **104**. In addition, the electrical connector **124** is physically configured to mate with the electrical connector **116** on the telephone **102**. Where the telephone **102** provides a coaxial connector **118** for a radio frequency signal line, the pocket **104** may provide a mating coaxial connector **126**. In this way, a particular telephone **102** may mechanically mate with the corresponding pocket **104**.

As mentioned above, the particular electrical signal lines provided by telephone **102** and the communications protocol used by the telephone **102** may vary between manufacturers, and even among the various models of telephones **102** produced by a particular manufacturer. Therefore, in order to electrically connect the telephone **102** to the pocket **104** and the docking station **106** and in turn the automobile **302**, provisions must be made to accommodate these differences. Accordingly, the pocket **104** may be designed to accommodate the particular configuration and type of electrical signal lines provided by the telephone **102**. In a physical sense, this is done by connecting the provided signal lines (*e.g.*, **304, 306, 308, 310, 312, 314, 303** and **316**) to the corresponding contacts, if so provided, in the electrical connector **116** and **118** of the telephone **102**.

Additionally, the pocket **104** is provided with a microprocessor **320** and associated pocket memory **324** for interfacing with the provided telephone control signals **314** of the telephone **102**. In this way, the electrical and communications protocols of the telephone **102** can be accommodated by the particular pocket **104** designed for use with the particular telephone **102**. Specifically, the memory **324** of the pocket **104** contains code that allows the pocket **104** to translate between commands formatted in the API of the system **100** and the proprietary communications interface of the telephone **102**. Although the pocket **104** is physically and electrically configured for use with a particular telephone or telephones **102**, it is desirable that the docking station **106** be capable of operating with

any of the provided pockets **104** and associated telephones **102**. Providing a common docking station **106** may reduce the cost of the system **100**, as only the pocket **104** need be varied to accommodate the wide variety of telephones **102** available in the marketplace. To further increase the advantages gained by using a common docking station **106**, many of the components necessary to provide the functions of the system **100** are located in the docking station **106**. Conversely, the number and cost of components necessary for the pocket **104** to provide the desired functions are kept to a minimum. In addition, although the docking station **106** may be capable of carrying out a certain number of functions, all of these functions may not be available to a user who has a pocket **104** that allows access to only a limited number of the potentially available functions. Also, the functions supported by a particular pocket **104** may be varied according to the operational functions available using the particular telephone **102** or according to the functions supported by the particular pocket **104**.

With reference now to **Fig. 6**, a plurality of pockets **104a, 104b, 104c, 104d, 104e, 104f, 104g** and **104h** are shown, each having differing physical and/or functional compatibilities, but that are all physically and functionally compatible with a common docking station **106**. The pockets A1 **104a,** A2 **104b,** A3 **104c**, and A4 **104d** may, for instance, be compatible with the physical characteristics of telephones A1 **102a,** A2 **102b,** and A3 **102c** produced by a single manufacturer A. Pockets B1 **104e**, B2 **104f**, B3 **104g** and B4 **104h** may be physically compatible with telephones B1 **102d**, B2 **102e**, B3 **102f**

and B4 **102g** produced by manufacturer B, or alternatively produced by manufacturer A, but having different physical characteristics from telephone **102a, 102b** and **102c.** Although in the example the pockets **104a-d** are physically compatible with the telephones **102a-c** , and the pockets **104e-h** are physically compatible with telephones **102d-g,** all the various functionalities of telephones **102a-c** may not all be supported by the pockets **104a-d** and all the various functionalities of the telephones **102d-g** may not all be supported by the pockets **104e-h.** Similarly, the functional or other capabilities of the pockets **104a-h** may not all be supported by all of the telephones **102a-g.** In **Fig. 6**, the functional compatibilities between the individual pockets **104a-h** and the individual telephones **102a-g** are illustrated by arrows. A solid arrow from a pocket **104** to a telephone **102** indicates that all of the functions of the particular telephone **102** are supported by the particular pocket **104,** while solid arrows from a telephone **102** to a pocket **104** indicate that all of the particular pocket's **104** capabilities are supported by the particular telephone **102.** A dotted line from a telephone **102** to a pocket **104** indicates that only a subset of the pocket's **104** capabilities are supported by the particular telephone **102,** while a dotted line from a pocket **104** to a telephone **102** indicates that only a subset of the particular telephone's **102** capabilities are supported by the particular pocket **104.**

As an example, telephones A1 **102a,** A2 **102b,** and A3 **102c** may share common physical attributes, allowing any of those telephones to be mechanically interconnected to any of the pockets A1 **104a,** A2 **104b,** A3 **104c**, and A4 **104d.** However, the telephones

A1 **102a,** A2 **102b,** and A3 **102c** may have differing functional capabilities. Likewise the pockets A1 **104a,** A2 **104b,** A3 **104c**, and A4 **104d** may support different functions. For instance, pockets A1 **104a**, A2 **104b**, and A3 **104c** may support all of the functional capabilities of telephones A1 **102a** and A2 **102b**, but only a subset of telephone A3's **102c** capabilities while pocket A4 **104d** may support all of the functional capabilities of telephones A1 **102a**, A2 **102b** and A3 **102c**. Telephones A1 **102a** and A2 **102b** may support all of the functional capabilities of pockets A1 **104a**, A2 **104b**, and A3 **104c**, but only a subset of the functional capabilities of pocket A4 **104d**, while telephone A3 **102c** may support all of the functional capabilities of pockets A1 **104a**, A2 **104b**, A3 **104c** and A4 **104d**. Examples of the interaction between pockets **104** having differing functional capabilities and telephones **102** having differing functional capabilities will now be explained in the context of various examples.

The pocket A1 **104a** may be a level one pocket supporting only the most basic functions provided by the system **100**. Thus, the pocket A1 **104a** may provide basic speaker phone functions when interconnecting telephones A1 **102a**, A2 **102b** or A3 **102c** to the docking station **106**. The basic speaker phone functions may comprise the provision of a speaker **366** and microphone **368**, to allow the user to carry on a conversation transmitted over a wireless link by the telephone **102** without having to hold the telephone **102** to his or her face. Thus, with reference now to **Fig. 3**, the pocket A1 **104a** may provide analog audio signal lines **304** and **306** to support analog audio signals

from and to the telephone **102**, where the telephone, *e.g.*, telephone A1 **102a**, provides an analog audio input and output. The pocket A1 **104a** may also provide analog audio amplifiers **318** and **502** (see **Fig. 5**) to allow for the gain of the analog audio signals to be adjusted. The pocket A1 **104a** then provides connections for the analog audio signals to the docking station **106**. Where the telephone A1 **102** provides a digital input or output, for example, telephone A2 **102b**, the pocket A1's **104a** digital audio signal lines **308** pass the digital audio signal directly to the docking station **106**. In general, the capabilities and specifications of the telephone **102** are communicated to the docking station **106** by the pocket **104** via the pocket- docking station communications bus when the pocket **104** is initially interconnected to the docking station **106**.

The pocket A1 **104a** also may provide a power line **303** for charging the battery **107** of the telephone **102** and/or providing electrical power to operate the telephone **102**. The pocket A1 **104a** additionally includes telephone control signal lines **314** between the telephone **102** and the microprocessor **320**. Finally, the pocket A1 **104a** may provide a radio frequency signal line **316**, where a radio frequency output connector **118** is provided by the telephone **102**.

According to the embodiment of the system **100** having a level one pocket A1 **104a**, the telephone **102** is physically held in position in the automobile **302**, and is provided with speaker phone functionality. Thus, where a telephone call is placed from a remote site to the telephone **102**, the user must generally press a button on the keypad **112**

of the telephone **102** to enable communications with the telephone at the remote site. The establishment of the communications link with the remote site is signaled to the pocket **104** by the telephone **102** over the telephone control signal lines **314**. The form of the signal given by the telephone **102** is generally proprietary to the manufacturer of the telephone **102**. Accordingly, it may consist of a serial digital message, or simply by a change in the voltage at an electrical contact on the telephone **102**. The pocket **104**, and in particular the microprocessor **320**, is programmed to recognize the particular message sent from the telephone **102** to indicate that a call is in progress. The microprocessor **320** then converts the message from the telephone **102** into one complying with the application programming interface (API) of the system **100**. This message may be transmitted from a serial I/O port provided on the microprocessor **320** over the pocket- docking station communication bus **322** to the far-end UART **338** and from there to a parallel input/output port provided on the docking station microprocessor **328** of the docking station **106**. The docking station microprocessor **328** reviews the call-in-progress message that originated in the telephone **102** and that was translated into the API of the system **100**, and generally configures the system **100** so that it is ready to handle the call. In particular, the docking station microprocessor **328** activates the mute signal line **362** to mute any output from the automobile's **302** audio system **373**. When the telephone provides an analog audio input **306** and an analog audio output **304**, the docking station microprocessor **328** may also activate the analog audio output amplifier **318**. Thus, where

the telephone **102** provides an analog audio signal, that signal may be amplified by the analog audio amplifier **318** and passed to the docking station **106** wherein the analog signal is digitized by the far-end CODEC **336**. The now digital audio signal is then passed to the multiplexer **342** and on to the docking station microprocessor **328** at a serial I/O port. The docking station microprocessor **328** then may perform a variety of signal processing functions on the audio signal. These functions may include acoustic echo cancellation, line echo cancellation, noise reduction, and frequency equalization. The digital signal processor may also provide partial full duplex operation, and automatic volume control functions. The processed digital audio signal is then passed from a serial I/O port of the docking station microprocessor **328** to the near-end CODEC **334** where the digital audio signal is converted back into an analog signal. The analog signal may then be amplified to line level and conditioned in the analog audio amplifier **344** before being amplified by the audio system **373** or by a power amplifier associated with the speaker **366** and output by the speaker **366**.

Voice signals from the user in the automobile **302** are picked up at the microphone **368**, which may feature built-in noise reduction capabilities, and digitized by the near-end CODEC **344**, before being passed to the serial I/O port of the docking station microprocessor **328**. Again, various signal processing functions may be carried out in the docking station microprocessor **328**, before the digital audio signal is passed to the multiplexer **342** and on to the far-end CODEC **336**. The far-end CODEC **336** transforms

the digital audio signal into an analog signal that is passed to the telephone **102** for transmission over the air link to the remote site.

Where the telephone **102** provides digital audio inputs and outputs, for example, telephones A2 **102b** and A3 **102c**, the transmission of signals through the system **100** is generally as described above, except that the digital audio signals are passed between the telephone **102** and the docking station microprocessor **328** via the multiplexer **342**, without any intervening amplification, and without passing through the far end CODEC **336**.

The level one pocket A1 **104a** may also provide the telephone **102** with power for charging the battery **107** and operating the telephone **102** over power line **303**. In general, the microprocessor **320** of the pocket **104** will have been programmed to request the proper voltage or current from the programmable power supply **330** of the docking station **106**. Of course, the power needs of the telephone **102** may vary according to the operational state of the telephone **102** or the charge of the battery **107**. Therefore, the telephone **102** may request, for example, that power be supplied at a first voltage when the telephone **102** is in an idle state, and at a second voltage when the telephone **102** is in an active state. The signal requesting differing voltages may be passed from the telephone **102** over the telephone control signal lines **314** to the microprocessor **320** where the request is translated to the API of the system **100**. The docking station microprocessor

328 may then control the programmable power supply **330** to provide the requested power. The pocket may also include a current limiter or voltage regulator as required.

Because the pocket **104** is designed to provide a predetermined set of functionalities and to be used with a predetermined telephone or set of telephones **102**, the microprocessor **320** and in particular the memory **324** associated with the microprocessor **320** will have been programmed to translate the particular signals of the telephone **102** into commands included in the API of the system **100**. In addition, the pocket **104** will have been programmed with the power requirements of the telephone **102**. This information regarding the functions supported and requirements of the telephone **102** may be communicated over the pocket- docking station communications bus **322** to the docking station microprocessor **328** when the pocket **104** is plugged into the docking station **106**. The pocket **104** also communicates information regarding the functions supported by the pocket **104** to the docking station **106**. In general, the docking station **106** is activated when the pocket **104** is plugged into the docking station **106** and the pocket sense ground **326** is established between the pocket **104** and the docking station **106**.

A second pocket **104b**, known as a level two pocket, may provide additional functionalities. For example, the pocket **104b** may support audible prompts, voice commands and voice memorandum recording. As illustrated in **Fig. 6**, the functionalities of pocket A2 **104b** are fully supported by telephones A1 **102a**, A2 **102b** and A3 **102c**,

even though it provides this additional functionality. Also, the docking station **106** may be identical to the one described with reference to pocket A1 **104a**. With respect to the basic speaker phone functions provided by the system **100** in connection with pocket A2 **104b**, the functions and interconnections are as described above with respect to the pocket A1 **104a**.

In order to support voice commands, the pocket A2 **104b** must be programmed to convey appropriate messages between the telephone **102b** and the docking station **106**. For instance, the pocket A2 **104b** must be capable of providing the telephone **102** with a telephone control signal directing the telephone **102** to pick up an incoming call. This is in contrast to the example given above with respect to pocket A1 **104b** in which the user must press a button on the keypad **112** of the telephone **102** to pick up an incoming call. In addition, the microprocessor **320** of the pocket **104b** must include API commands for functions such as answering an incoming call. Apart from enabling additional functionalities such as voice recognition and voice memorandum recording, the pocket A2 **104b** is, according to one embodiment of the present invention, the same as pocket A1 **104a**.

Audible voice prompts are, according to an embodiment of the system **100** of the present invention, provided to guide a user operating the system **100**. Audible prompts are particularly advantageous when used in connection with voice recognition functions because they facilitate operation of the system **100** without requiring that the user look at

the system **100** itself. For example, the system **100** may acknowledge commands given by the user, or provide the user with information concerning the status of the system **100**. The audible prompts may be pre-recorded and stored in the pocket memory **324** and/or the docking station memory **340**, with or without compression. Alternatively or in addition, the audible prompts may be generated from text stored in memory **324** or **340** using a text to speech functionality (described below). According to one embodiment, the voice prompts are stored in easily changed memory **324** or **340** cartridges, to allow the existing system **100** to be upgraded, or to accommodate a different or an additional language.

The docking station **106** may include speech recognition functions to enable the system **100** to recognize voice commands. The docking station used in connection with pocket A2 **104b** may be identical to the docking station **106** used in connection with pocket A1 **104a**. Alternately, the docking station **106** used in connection with pocket A2 **104b** may be enhanced to provide voice recognition functions. Even if the docking station **106** is provided in various models offering differing capabilities, any docking station **106** is preferably compatible, at least in part, with any pocket **104**. In general, speech models are stored in the docking station memory **340** or the pocket memory **324** to enable the system **100** to recognize universal commands such as "answer call" or "place call." Different memory **324** or **340** cartridges may be provided to conveniently upgrade the speech models or change them to a different language. In addition, provision may be made in the

docking station **106** for storing user defined commands, such as "call home" or "call Mary." According to one embodiment of the present invention, the user defined commands and voice memoranda may be stored in removable memory **324** or **340** to facilitate their use in other systems **100** or in compatible devices, to archive memoranda, or to allow the use of different command sets. The removable memory **324** or **340** may comprise a RAM memory card. The pocket A2 **104b** may be provided with buttons **142** (see **Fig. 1B**) to enable the user to signal the system **100** to enter a voice command mode or voice memo record mode.

The operation of the system **100** in processing a voice command will now be explained in the context of an example. Where a telephone call is not in progress (*i.e.* the telephone **102** is on-hook), a user may command that a general voice recognition mode be entered by uttering a special initiator word (*e.g.*, "CellPort"). The system **100** may also be provided with a "barge-in" capability to allow voice recognition mode to be entered even while a telephone call is in progress (*i.e.* the telephone **102** is off-hook). Alternatively, the user may press a button **142a** provided on the exterior of the pocket **104b** to place the system **100** in voice recognition mode. Upon receiving the signal to enter voice recognition mode, the processor **320** sends a message across the pocket- docking station communication bus **322** to the docking station microprocessor **328** via the UART **338**. The message sent by the microprocessor **320** is formatted according to the API of the system **100**. Upon receiving the message to enter voice recognition mode, the docking

station microprocessor **328** activates or otherwise communicates with the microphone **368**. When a voice command is used, the docking station microprocessor **328** will cause the system **100** to enter a general voice recognition mode after a prescribed voice command has been issued by the user

Voice commands issued by the user are converted into analog electrical signals by the microphone **368** and passed through the near-end CODEC **334**, where the analog signals are digitized. The digitized voice commands are then compared in the docking station microprocessor **328** to the standard and customized speech models stored in the flash memory **340**. If, for example, the user issues the command "call home," the docking station microprocessor **328** will attempt to match those words to the stored word models. Upon finding a match, the docking station microprocessor **328** will initiate action according to the command. Thus, when the command "call home" is received, a signal to initiate a telephone call will be formatted in the API of the system **100**, and passed to the microprocessor **320** of the pocket A2 **104b**, where the API command is translated into a signal understood by the telephone **102**. Where the telephone number associated with "home" is stored in memory **324** or **340**, the command to the telephone **102** may consist of the digits of the telephone number and the send command. Alternatively, where the telephone **102** allows access to telephone directories stored in its internal memory, the command from the docking station microprocessor **328** may be in the form of a command

to retrieve a number from a specified memory location in the telephone **102** and to initiate the send function.

The functions provided by the level two pocket A2 **104b** may also include provisions for voice memo recording. Thus, by pressing the associated buttons **142b**, or by issuing the appropriate voice command, such as "take a memo", the system **100** may be configured to record a voice message. Such a capability is useful, for instance where a user wishes to give him or herself a reminder to do something without having to write the reminder down with pencil and paper. The voice memorandum capability is also useful for recording directions or a telephone number given by the person at the other end of the communications link. In voice memo recording mode, the voice message is converted to an analog electrical signal by the microphone **368** and transmitted to the near-end CODEC **334** where the signal is digitized. The digital voice memo is then processed and compressed by the docking station microprocessor **328** and stored in memory **340**. When the user wishes to retrieve the voice memo, the user may press a button **142c** on the pocket A2 **104b** causing a command to be sent from the microprocessor **320** across the pocket- docking station communication bus **322** to the docking station microprocessor **328**, in the API of the system. The docking station microprocessor **328** then retrieves the message from memory **340**, decompresses the message, performs signal processing functions, and provides a digital output of the message to the near-end CODEC **334**, which converts the memo to an analog signal that is then amplified by the amplifier **344**

and output at the speaker or headset **366**. Where the command to replay a previously recorded voice memo is in the form of a voice command, the recognition of the voice command by the docking station microprocessor **328** initiates the retrieval of the voice message from memory **340** for playback through the speaker **366**. In addition or as an alternative to playback through the speaker **366**, the memorandum may be transmitted to another device for playback. For example, the memorandum could be transmitted by the telephone **102** to a remote telephone or device, or it could be transmitted to a computer or other external subsystem **378** for playback.

A next level of functionality may be provided by the system **100** in connection with a pocket A3 **104c**. The additional functions provided by the pocket **104c** may include storage for voice memos, directories and customized voice commands in the pocket **104**. As illustrated in **Fig. 6**, the functionalities of pocket A3 **104c** are fully supported by telephones A1 **102a**, A2 **102b** and A3 **102c**. The docking station **106** may be identical to the docking station used in connection with any of the pockets A1-A4 **104a-c** and B1-B4 **104e-h**. The functionalities pocket A3 **104c** shares with pockets A1 **104a** and A2 **104b** may be executed in the same manner as described above.

The pocket A3 **104c** is provided with memory **324** sufficient to allow the recordation of voice memos and for the storage of voice commands and directories programmed by the user in the pocket A2 **104c**. In addition, a UART may be provided in the pocket A3 **104c** to synchronize the transfer of voice memos and voice command data

between the docking station **106** and the pocket **104**. In general, the voice memo recording function using the pocket A3 **104c** is identical to the function when carried out by pocket A2 **104b**. However, the provision of additional memory **324** in the pocket A3 **104c** allows for voice memos to be stored in the pocket A3 **104c**. According to one embodiment of the present invention, voice memoranda may be stored in the pocket memory **324** as each memorandum is recorded. Alternatively, voice memoranda may be stored initially in the docking station memory **340**, and later transferred to the pocket memory **324** automatically when the system **100** has the resources available to complete such a transfer. As yet another alternative, the user may initiate a transfer of voice memoranda data to the memory **324** in the pocket A3 **104c** by, for example, pressing a button provided on the pocket A3 **104c** or by issuing an appropriate voice command. Control logic provided in the pocket microprocessor **320** and/or the docking station microprocessor **328** may be provided to control whether data already written to the memory **324** is overwritten by new data. For example, the user may be notified when the memory **324** is full, and given a choice as to whether old data should be overwritten. After the voice memoranda has been transferred to the pocket memory **324**, the pocket A3 **104c**, which is easily disconnected from the docking station **106**, can then be taken to, for example, the user's office. The pocket A3 **104c** may then be interconnected to a device in the office having a microprocessor and associated speaker, similar to the docking station

106, for playback of stored messages. The UART **402** in the pocket A3 **104c** allows the memo data to be transmitted over a dedicated line for storage in the pocket A3 **104c**.

The ability to store customized directories and voice commands in the pocket A3 **104c** allows a user to use those customized features in any car equipped with a suitable docking station **106**. Therefore, by moving the telephone **102** and the pocket A3 **104c** different users may share an automobile, while retaining access to their own directories and commands. This feature is also useful where a user rents an automobile provided with a docking station **106**, as all of the user's personalized information can be carried in the pocket A3 **104c**.

A further level of functionality may be provided by the system **100** in connection with pocket A4 **104d**. As illustrated in **Fig. 6**, the functionalities of pocket A4 **104d** are fully supported by telephone A3 **102c**, but only partially supported by telephone A1 **102a** and telephone A2 **102b**. Pocket A4 **104d** fully supports the functionalities of telephones A1-A3, **102a-c**. The additional functionalities provided or enabled by pocket A4 **104d** may include text to speech capability. The text to speech function allows the system **100** to convert information received in the form of written text to audible speech. However, the text to speech function generally requires a telephone **102** capable of receiving textual information. According to the example illustrated in **Fig. 6**, telephone A3 **102c** is the only telephone from manufacturer A having e-mail or Internet browsing capabilities. In the example of **Fig. 6**, telephones A1 **102a** and A2 **102b** lack the capability to receive

information in the form of text and therefore cannot fully support the text to speech function. However, it should be noted that some text to speech capability may be possible in connection with telephones A1 **102a** and A2 **102b**, for example where information in the display **114** of the telephone **102a** or **102b**, such as caller ID information, is provided at the electrical connector **116** of the telephone **102a** or **102b**, in which case the information can be presented to the user as audible speech. In addition, the text to speech function may service other subsystems **378** capable of providing textual output. Generally, the pocket **104d** provides all of the functions described above with respect to pockets A1-A3, **104a-c**.

The pocket A4 **104d** is provided with commands in the microprocessor **320** to support the receipt of textual information from the telephone **102c**. The information received by the telephone **102c** is formatted into the API of the system **100** by the microprocessor **320** and transmitted to the docking station **106** over the digital data signal line **308** or the pocket- docking station communication bus **322**. According to one embodiment of the present invention, the docking station **106** for use in connection with the pocket A4 **104d** includes an additional processor at the custom interface **348**, which may be conveniently mounted on a daughter board **380,** for performing the text to speech function. Generally, the processor at the custom interface **348** transforms the received text into digitized speech, which can then be passed to the docking station microprocessor **328**, and from there to the near-end CODEC **334** for conversion to an analog audio signal.

The analog audio signal is then output through the speakers **366**. The use of an additional processor at the custom interface **348**, which can be added to the normal docking station **106**, is desirable in that it allows for the use of a specialized processor for handling the relatively complex text to speech translation function. Additionally, it allows docking stations **106** not intended for use with a text to speech enabled pocket **104** and telephone **102** to be produced at a lower cost. As alternatives, the docking station microprocessor **328** may be sufficiently powerful or robust to perform the text to speech function, or an enhanced docking station **109**, having a text to speech enabled docking station microprocessor **328** may be offered in addition to the normal docking station **106**. As a further alternative, an enhanced microprocessor **320** in the pocket, or an additional microprocessor, may be provided in the pocket A3 **102c** to handle the text to speech function. Apart from enabling additional and/or different functionalities, such as text to speech, the pocket A3 **104c** is generally the same as pocket A1 **104a** and A2 **102b**.

In connection with the above description of pockets A1-A4 **104a-d** and their functional capabilities, a user may generally choose the capabilities of the system **100** according to the user's needs and desires by choosing the appropriate pocket A1-A4 **104a-d**. Thus, a user owning any of telephones A1-A3 **102a-c** can choose a system **100** having basic hands-free capabilities by purchasing pocket A1 **104a** and docking station **106**. By purchasing pocket A2 **104b** and a docking station **106**, a user may obtain voice command and voice recording capabilities. The use of pocket A3 **104c** in connection with a docking

station **106** provides the user with a system **100** that allows voice memos and programmed voice command information to be stored in the easily transported pocket A3 **104c**. Accordingly, it is the pocket A1 **104a**, A2 **104b**, or A3 **104c** that determines what capabilities the system **100** provides when used in connection with either a telephone A1 or A2 **102a** or **102b**. Also, when purchasing a new pocket **104** in order to obtain advanced features or to accommodate a different telephone **102**, the user need not replace the docking station **106**. Furthermore, the same docking station **106** may be used in connection with pockets A1-A3 **104a-c**.

A system **100** providing text to speech capabilities may be obtained by using a docking station **106** with an additional or an enhanced processor or an enhanced docking station **109**, pocket A4 **104d**, and telephone A3 **102c**. Although the docking station **106** or **109** used in connection with pocket A4 **104d** in this example provides enhanced capabilities, it should be noted that, except for the text to speech function, pocket A4 **104d** is fully supported and fully compatible with the general docking station **106**. Similarly, pocket A4 **104d** can be used with telephones A1 or A2 **102a** or **102b**.

With continued reference to **Fig. 6**, the relationship between telephones B1-B4 **102d-g**, pockets B1-B-4 **104e-h**, and docking station **106** are illustrated. In general, pockets B1-B4 **104e-h** provide the four levels of functionality described above with respect to pockets A1-A4 **104a-d**, but are designed to physically and electrically interconnect with telephones B1-B4 **102d-g** produced by manufacturer B. However, the

pockets B1-B-4 **104e-h** are designed to work with the same docking station **106** as pockets A1-A4 **104a-d**.

As shown in **Fig. 6**, pockets B1 and B2 **104e** and **104f** are fully compatible with telephones B1 and B2 **102d** and **102e**, but only partially compatible with telephones B3 and B4 **102f** and **102g**. Additionally, pockets B3 and B4 **104g** and **104h** fully support the functional capabilities of telephones B3 and B4 **102f** and **102g**, but are only partially compatible with telephones B1 and B2 **102d** and **102e**. This situation may occur, for instance, where telephones B1 and B2 **102d** and **102e** feature an older interface used by manufacturer B, while telephones B3 and B4 **102f** and **102g** use a newer interface. Therefore, even though the telephones B1-B4 **102d-g** may have the same physical characteristics, changes to the interface used to control and send data to and from the telephones **102d-g** will affect their compatibility with the pockets **104e-h**. According to an embodiment of the system **100**, where a user has upgraded their telephone **102**, but wishes to use a pocket having an interface adapted for an earlier model of the telephone **102**, provided that the telephone **102** and pocket **104** are still physically compatible, the pocket **104** can be upgraded by modifying the memory **324** of the pocket **104** to enable the pocket **104** to properly interact with the telephone **102**.

Modifications to the memory **324** may be made by transmitting the upgrade to the memory **324** through a physical connection to a component of the system **100**. For example, the pocket **104** may be connected to a personal computer that has been used to

download a programming upgrade from an Internet website, or to read new programming code distributed on a floppy disk, CD ROM, or other storage medium. Alternatively, the docking station **106** could be connected to a personal computer, and new programming code loaded onto the memory **340** of the docking station **106**. Regardless of whether the pocket **104** or the docking station **106** is used to initially receive the updated programming code, the programming code resident in the pocket memory **324**, the docking station memory **340** or both can be modified using the above-described methods. Where a telephone **102** capable of downloading information from the Internet is available, that telephone **102** may be used to download new programming code to upgrade the pocket **104** and/or the docking station **106**. Another method of upgrading the programming code of the system **100** is for the user to purchase an upgraded pocket **104** that contains new programming code for upgrading the code stored in the docking station memory **340**. Similarly, a docking station **106** containing the necessary code may be used to upgrade the code resident in the pocket memory **324**. As yet another method of upgrading the code resident in the memory **324** or **340**, all or portions of the memory **324** or **340** may be augmented or replaced by memory **324** or **340** having upgraded programming code.

However, modifying the memory **324** to properly translate between a new telephone interface and the API of the system **100** will not be sufficient where the manufacturer has made changes to the physical configuration of the telephone **102**. Also, changes to the memory **324** alone will not be sufficient where the user has, for instance,

purchased a new telephone from a different manufacturer having a different physical configuration. In these instances, compatibility with the system **100** may be regained by purchasing a new pocket **104** that is compatible with the user's new telephone **102**. The purchase cost of a pocket **104** is preferably much less than the purchase cost of both a pocket **104** and a docking station **106**, as the docking station **106** originally purchased by the user may be used with the new pocket **104**.

The multiple-processor multiple-bus configuration of the system **100** allows the system **100** to be designed using modular units. In particular, the system **100** provides a pocket **104** for at least every combination of physical and electrical characteristics found in supported telephones **102**. The system **100** allows the use of a common docking station **106** by converting the unique physical and electrical characteristics of supported telephones **102** to a common electrical and physical interface at the pocket **104**. Therefore, common system components can be placed within the docking station **106**, while particular attributes required by particular telephones **102** can be accommodated by the pocket **104**. In this way, the cost of the system **100** can be reduced and the flexibility increased.

The application programming interface (API) of the system **100** is the common language used to communicate commands and information between the pocket **104** and the docking station **106**. Translation between the interface of the telephone **102** and the API of the system **100** is performed in the pocket **104**, and in particular in the

microprocessor **320**. After translation in the microprocessor **320**, commands and information originating at the telephone **102** can be transmitted using the API to the docking station **106** over the pocket- docking station communication bus **322**. Commands and data originating at the docking station **106** and at the system **100** follow the reverse course, with commands and data formatted in the API of the system **100** being translated into the telephone's **102** unique interface at the microprocessor **320** of the pocket **104**.

Where the system **100** is to be interconnected with subsystems **378** in addition to the telephone **102**, an additional processor or custom interface **348** may be provided to perform translation between the API of the system **100** and the interface of the subsystem **378** to which the system **100** is interconnected. Preferably, the custom interface **348** may be provided in the form of an add-on or daughter board **380** that can be interconnected to the docking station microprocessor **328** using provided electrical contacts. Thus, connectivity to various other subsystems **378** may be achieved without requiring changes to the docking station's **106** main components or to the pocket **104** presently in use. Alternatively, or in addition, the subsystem **378** can communicate using the API of the system **100**, without requiring any translation. For example, the interface required to communicate with an external subsystem **378** may be resident in the docking station **106**. The custom interface **348** and daughter board **380** may simply provide a mechanical connection, or may not be provided at all where the external subsystem **378** interface is resident in the docking station **106**.

As mentioned above, the external subsystem **378** may comprise a variety of electronic devices. The subsystem **378** may include protocol based units and close-ended devices. The protocol based units can include networks and busses having associated components or peripheral devices that are interconnected. The close-ended devices are referred to herein as devices that do not have International Standards Organization (ISO) network layering and typically constitute a terminating communication node in the context of data flow ending or originating from such device, and not typically acting as a link or pass-through device for information or data transfers. An example of such a close-ended device might be a global positioning system (GPS) that is useful in providing vehicle location information, or a hardware device, such as a vehicle sensor, from which data can be obtained for a particular vehicle component to which the sensor is operably connected.

In addition to the GPS, the external subsystem **378** may include an Internet Protocol (IP) stack comprised of a number of network layers that are commonly involved in transfers using the Internet. The external subsystem **378** can also include an intelligent transportation system data bus (IDB) and/or an on-board diagnostics (OBD) system that are involved with monitoring and providing information related to vehicle components.

The external subsystem **378** may also include computing devices, such as laptop or notebook computers, PDA's, or other devices. The external subsystem **378** may also include applications running on such devices. In particular, the external subsystem may include Internet aware applications or other applications capable of passing data to or from another application over a communications link.

The external subsystem **378** may also include a controller area network (CAN) found in at least some vehicles and which includes a bus along which a number of vehicle elements communicate for supplying information concerning such elements. The CAN is operatively connected to each of a plurality of vehicle devices that transmit, receive, or both transmit and receive desired data. For example, the vehicle devices include transducers or other physical devices that detect and provide information useful to applications software for processing to obtain information that is then transmitted for storing in memory for later transmission, or even for immediate transmission without processing, upon receipt of the proper request or command. Other available networks could be utilized, instead of CAN, such as Arcnet, which has a protocol similar to CAN. Where the external subsystem **378** includes one of a plurality of vehicle busses, the hardware supplied for interconnecting the external subsystem to the docking station **106**, such as the daughter board **380**, may include provisions for signaling to the docking station microprocessor **328** the format of the output required by the particular external subsystem **378**. For example, the daughter board **380** may comprise cabling, and the presence or absence of a resistor between two signal paths may be used to indicate to the microprocessor **328** the proper voltage at which signals are to be transferred to and from the external subsystem **378**. For further information regarding obtaining information or data from vehicle devices, see U.S. Patent No. 5,732,074, filed on January 16,1996 and assigned to the assignee of the present invention. The external subsystem **378** may also

comprise an analog/digital converter (ADC), a standard serial bus, a universal serial bus (USB), an RS232 connection, a user datagram packet/Internet protocol stack, as well as one or more other custom proprietary devices.

Other devices that may comprise the external subsystem **378** may include a PCMCIA (Personal Computer Memory Card Interface Association) unit, which may include a storage device for storing desired information or data. The external subsystem **378** may also include a device capable of communication using the Bluetooth protocol, which provides a standard protocol for the wireless communication of information between disparate devices.

The protocol used for communications between the pocket **104** and the docking station **106**, according to an embodiment of the present invention, is half duplex. Accordingly, there can only be one message in the pocket-docking station bus **322** at any one time. Normally, messages are responded to with either an ACK, acknowledging correct receipt of the message, or a NACK, indicating a problem. A response may be suppressed by issuing a "do not acknowledge" command with the message. In general, the combined message-response pair must be completed before another message can be placed on the bus. A time out period for failed messages may be established, and messages not receiving an acknowledgment within a selected period of time (*e.g.*, 1 second), will be retransmitted up to a selected number of times (*e.g.*, 8 times).

According to an embodiment of the present invention, the pocket **104** acts as the bus master, and the docking station **106** acts as the slave. As master, the pocket **104** may

issue API commands to the docking station **106** at any time. Periodically, the pocket **104** issues a bus grant message to the docking station **106** after which the docking station **106** may send a command to the pocket **104**. After receiving the bus grant message, the docking station **106** can either send a pending message or reply with a bus release message. According to an embodiment of the present invention, the bus grant message is sent once every second, and the docking station **106** has 500 ms to issue a pending message or a bus release message.

With reference now to **Fig. 7**, the pocket communications state machine in accordance with another embodiment of the present invention is illustrated. Generally, as noted above, the pocket **104** and the docking station **106** are in a master and slave relationship. As shown in **Fig. 7**, at state **702**, the pocket **104**, and in particular the microprocessor **320**, awaits a message from the telephone **102**. Upon receiving a telephone message, the pocket **104** enters state **704** in which the telephone request is handled. After handling the telephone request, the pocket **104** then enters state **706** in which the telephone request is sent to the docking station **106**. Next, the pocket **104** awaits a message from the docking station **106** in state **708**. If no message is received from the docking station **106**, the pocket **104** then returns to state **702**. A system **100** also includes the timer that operates in cooperation with determining whether or not a message is received. During normal operation, when no response is received from the docking station **106**, another pulse or heartbeat is sent at predetermined times. However, if there is

no response within a time interval associated with the timer timing out, a hardware reset line is enabled to reset the docking station **106**. Where a docking station **106** message is received, the pocket handles the message in state **710**, following which it returns to state **702**. Where no telephone message is received, the pocket **104** periodically polls the docking station **106** at state **712**. According to an embodiment of the present invention, the pocket **104** polls the docking station **106** every 72 milliseconds (*i.e.* the pocket **104** heartbeat rate is 72 milliseconds). After polling the docking station **106** in state **712**, the pocket **104** enters state **708** in which it awaits a message from the docking station **106**. If no message from docking station **106** is received within 10 milliseconds of polling the docking station **106**, the pocket **104** returns to state **702**, in which it awaits a telephone **102** message. According to one embodiment of the present invention, communications between the pocket **104** and the docking station **106** occur at 19,200 baud, using eight data bits, one parity bit, and no stop bit. According to another embodiment of the present invention, the data between the pocket **104** and the docking station **106** is transmitted at 115200 bps, using 8 data bits, no parity, and one stop bit. However, other communication rates can be used, and may even be varied.

Referring now to **Fig. 8**, the architecture of the docking station **106** software showing the relationships among the various software objects, is illustrated. In general, the top level loop is the digital signal processor object **802**. Thus, the power supply control **804**, audio control **806**, flash file system **808**, user interface **810**, voice memo

recording **812**, voice recognition **814**, and pocket communications **816** objects can all be entered from the main loop **802** directly. Other software objects or modules are addressed in response to interrupts. Accordingly, communications between the pocket **104** and the docking station **106** generate an interrupt causing the software to enter the UART object **818**. Activity concerning the near-end CODEC **334** is handled at object **820** across the interrupt boundary from the voice memo recording **812** and voice recognition **814** objects. Sound processing **822** and far-end CODEC **824** objects are associated with the near-end CODEC **820** object.

The progression of typical communications scenarios are illustrated in **Fig. 9**. In **Fig. 9**, message A is shown originating in the pocket **104**. An acknowledgment of message A originates in the docking station **106**, and is transmitted to the pocket **104**. A second message, message B, originates at the pocket **104**, and is passed to the docking station **106**. After a one second time out, during which no message is received at the pocket **104**, message B is retransmitted. Next in the diagram, the pocket **104** issues a bus grant message. In response to the bus grant, the docking station **106** issues a pending message, message C. In response to message C, the pocket **104** issues an acknowledgment. The pocket **104** next issues another bus grant. In response, the docking station issues a bus release message, as the docking station has no pending message. After one second, the pocket **104** again issues a bus grant message. Receiving no reply, after a 0.5 second time out, the pocket **104** issues a second bus grant message.

Again receiving no reply, the pocket **104** issues yet an other bus grant message. The above-described typical scenarios serve as examples, and it will be appreciated that additional alternative scenarios are possible.

With reference now to **Fig. 10**, a pocket **104** worst case scenario is illustrated. In **Fig. 10**, message A, is shown queued in the docking station **106**. Message A is released after synch 2 to the pocket **104**. At the time Message A is released, Message b is received from the telephone **102**. In response to this situation, the pocket can immediately pass Message A to the telephone and return Response A to the docking station, while delaying handling of Message B from the telephone, or the pocket can communication Message B to the docking station as Message B while delaying the handling of Message A.

With reference now to **Fig. 11**, a docking station **106** worst case scenario is illustrated. In **Fig. 11**, Message C is shown queued in the docking station **106**. Shortly after Message C is queued, Message a is received at the telephone **102** and is communicated through the pocket **104** and to the docking station **106** as Message A. Then while Message C continues to be queued, Response A is communicated to the telephone **102** as Response a. Message B is then received at the telephone **102** and is communicated to the docking station **106** through the pocket **104** as Message B. The docking station **106** then sends Response B through the pocket **104** into the telephone **102** as Response b. Following the receipt of Response b at the telephone **102**, a synchronization signal, labeled Synch 2, is sent from the pocket **104** to the docking station

106, causing the release of the queued message. Message C is then delivered to the pocket **104**, and Response C delivered from the pocket **104** to the docking station. Therefore, in this worst case scenario, Message C could not be handled until Messages A and B had been dealt with, and the synchronization signal received.

According to one embodiment of the system **100** of the present invention, the docking station **106** is provided with programming instructions necessary for communicating with the telephone **102**. According to this embodiment, the pocket **104** need not be provided with a microprocessor **320** or memory **324**. Instead, the pocket **104** may simply provide a physical interconnection to the telephone **102**, and for the transfer of signals from the telephone **102** directly to the docking station **106**. Where the docking station **106** is not intended to interconnect to telephones **102** having a variety of physical characteristics, the pocket **104** need not be a component that is separate and distinct from the docking station **106**. According to one embodiment, the docking station **106** may be provided with programming code enabling it to interface with a variety of telephones **102**. Thus, the pocket **104** may provide a signal to the docking station **106**, for example, by providing differing voltage levels at input pins associated with the docking station **106** microprocessor **328** to indicate the type and capabilities of the telephone **102**. The docking station **106** may use this information to select the appropriate command set for communicating with the telephone **102**. The docking station **106** may be upgraded to provide advanced capabilities, or to communicate with additional telephones **102** through

upgrades to the programming code generally stored in the docking station memory **340**. The upgrades may be provided to the docking station **106** by interconnecting the docking station **106** to a personal computer that has read or downloaded the code upgrade, or by downloading the upgrade through an Internet-enabled telephone **102** directly to the docking station **106**.

The text to speech functionality described above with respect to certain embodiments of the present invention may be augmented by the ability to visually display textual information. Accordingly, textual information may be displayed, for example, on a screen associated with an external subsystem **378**. Thus, textual information may be displayed on the screen of a personal digital assistant (PDA), a personal computer, or a display screen provided by the automobile **302**. The system **100**, upon receipt of textual information, may in a default mode provide a visual output of text where a visual display is interconnected to the system, and an audible output. The user may also select whether textual information is to be provided audibly or visually. For example, a user may command the system **100** to "read e-mail." Alternatively, the user may command the system **100** to "display e-mail."

The system **100**, particularly in connection with an automobile **302**, may provide a variety of useful, automated functions. For example, the docking station **106** may be provided with a custom interface **348** that includes a telematics module to monitor activity occurring on an external subsystem **378**. For instance, where a first external subsystem

378 is a vehicle bus, a message indicating a low fuel status transmitted over the bus may be decoded by the custom interface **348**. The custom interface **348** may then cause a query to be transmitted over the wireless link provided by the telephone **102** to a central station interconnected to the Internet. The query, which may be transmitted from the telephone **102** according to the Internet protocol, may request the location and prices of fuel available in the area. The response to the query may be provided to the user of the system **100** through a visual display provided as, for example, a second external subsystem **378**, or may be provided audibly to the user through the text to speech capabilities of the system **100**. According to one embodiment, the query includes information concerning the location of the automobile **302**. Such information may be provided automatically, for example, from a GPS receiver interconnected to the system **100** as a third external subsystem **378**. Alternatively, location information may be provided by a telephone **102** capable of receiving GPS data.

With reference now to **Fig. 12**, a system **100** in accordance with an embodiment of the present invention is illustrated. The system **100** shown in **Fig. 12** interconnects a telephone **102** to a plurality of applications **1200a, 1200b**, and **1200c** running on external subsystems **378a, 378b** and **378c**. As shown in **Fig. 12**, the docking station **106** of the illustrated embodiment includes an interface or a custom interface **348**, which may be included as part of a data daughter board (DDB) **380,** for providing an interface between the docking station **106** and the external subsystems **378a-c**. Although the following

discussion will generally describe an interface **348** that is provided as part of a data daughter board **380**, the interface **348** may be provided as part of the docking station **106** itself. For example, the interface **348** or any other interface, may be provided as part of a main circuit board of the docking station **106**. Alternatively, at least some of the components or functions of the interface **348** may be provided as part of a cable interconnecting the external subsystem to the docking station **106**.

The interface **348** may include a local network interface **1204** for providing ports **1208a-b** via a network hub **1210** to interconnect subsystems **378a** and **378b**, and the associated applications **1200a** and **1200b**, to the docking station **106** over signal lines **376a** and **376b**. For example, the local network interface **1204** may comprise an interface for TCP/IP formatted data, such as an Ethernet network card. Although only two applications **1200a** and **1200b** are illustrated as being interconnected to the docking station **106** over signal lines **376a** and **376b**, it can be appreciated that the number of applications **1200** that can be so interconnected is limited only by the capacity of the local network. As will be understood by those of skill in the art, the hub **1210** may be integral to the interface **348**, may be provided on a data daughter board or may be provided separately. Alternatively, the network interface **1204** may be used to interconnect the docking station **106** to an application **1200** without the use of a hub **1210**. Therefore, the network interface **1204** may comprise a network hub alone or in combination with a

network interface card. As will also be understood by those of skill in the art, more than one application **1200** may be running on a single external subsystem **378**.

The interface **348** may, in addition or as an alternative to a local network interface **1204** for use with wired signal lines **376a** and **376b**, comprise a local wireless network interface **1212**. In an embodiment in which a local wireless network interface **1212** is provided, a wireless line or lines of communication **376c** serves to transmit information between the local wireless network interface **1212** and the application **1200c** running on the external subsystem **378c**. The local wireless network interface **1212** may be interconnected to the docking station **106** via a connection to a port on the network interface **1204** or the hub **1210**. Alternatively, the wireless interface **1212** may be directly interconnected to the docking station **106**. Although only one application **1200c** is shown in communication with the docking station **106** over the wireless signal line **376c**, it can be appreciated that the number of applications so interconnected depends only on the capacity of the local wireless network. Furthermore, it will be appreciated that more than one application **1200** may be running on a single external subsystem **378** interconnected to the docking station by the wireless signal line **376c**.

In general, the interface or interfaces **348** provided by the docking station **106** allow information to be passed between the docking station **106** and the interconnected external subsystems **378** as digital packet data. For instance, data may be passed between the interface **348** and the external subsystems **378** as packets of data formatted according

to a data transmission protocol, such as the TCP/IP protocol. By providing a standard interface (*i.e.* the interface **348**), the data daughter board **380** allows the docking station **106** to interface with any application **1200** running on an external subsystem **378** that is capable of communicating over a network using such a data transmission protocol. Therefore, the applications **1200** may include applications running on an external subsystem **378** comprising a computer equipped with a network interface that is compatible with the interface **348**. Suitable computers include laptop and notebook computers. In addition, an application **1200** may be executed on a personal digital assistant (PDA) or other device having an appropriate network connection. In general, any external subsystem **378** and associated application or applications **1200** capable of communicating with the provided interface **348** may be interconnected to the docking station **106** by the data daughter board **380**. Accordingly, it can be appreciated that the interface **348** of the docking station **106** provides a physical communications layer between the external subsystem **378** and the docking station **106**. The docking station **106**, in cooperation with the adaptor **104**, also provides translation between the control commands used for communication between an application **1200** and the docking station **106**, and the command set needed to operate the telephone **102**. Accordingly, it should be appreciated that due to the physical and logical interface provided by the docking station **106** and the adaptor **104**, neither the external subsystem **378** nor the application **1200** is

required to provide the particular physical and logical interface required by the particular telephone **102** used to establish a communications channel **1220**.

Communications received from the applications **1200** are passed from the docking station **106** to the adaptor **104** by either the digital data path signal lines **308** or the pocket- docking station bus **322**. Communications passed over the pocket-docking station bus **322** generally comprise wireless communications device control commands, as will be described in greater detail below. Data passed along the digital data path signal lines **308** generally includes data for transmission by the telephone **102**. Accordingly, data passed along the digital data path **308** is, according to one embodiment of the present invention, not altered by the adaptor **104** before it is transmitted to a base station or server **1216** by the telephone **102** across wireless communications channel **1220**. According to another embodiment of the present invention, the data passed along the digital data path **308** is reformatted, such as from a serial bit stream format used along signal lines **376** to a parallel bit format used by the telephone **102**. The reformatting of the data, where necessary, may be performed by the adaptor **104**. Communications passed across the pocket-docking station bus **322** are generally translated by the adaptor **104** into the format required by the telephone **102** before being passed to the telephone **102** over the telephone control signal bus **314**. For instance, communications channel control commands passed from an application **1200** to the docking station **106** will, according to one embodiment of the present invention, be translated into at least a first command selected from a set of

system commands according to the API of the system **100** by the docking station **106**, and these in turn will be translated by the adaptor **104** into corresponding wireless communications device control commands that can be understood by the telephone **102**.

With reference now to **Fig. 13**, details of a data daughter board **380** comprising the interface **348** in accordance with an embodiment of the present invention are illustrated. As seen in **Fig. 13**, the local network interface **1204** is interconnected to a processor **1300** by an internal bus **1304**. In the embodiment illustrated in **Fig. 13**, a local wireless network interface **1212** is interconnected to the processor **1300** via the local network interface **1204** and internal bus **1304**. Accordingly, in this embodiment of the data daughter board **380**, the local wireless interface **1212** acts as a device or network gateway interconnected to the local network interface **1204**.

The processor **1300** may include a microprocessor or a digital signal processor. In general, the processor **1300** examines data packets received from the local network interface **1204** to determine whether they contain control commands directed to the operation of the telephone **102**, or data for transmission across the wireless communications channel **1220**. According to one embodiment of the present invention, control commands have a unique address to indicate to the processor **1300** that a communications channel control command is contained in the packet of data. For instance, control commands may be addressed to a virtual control data port established by the interface **348**. Communications channel control commands are translated by the

processor **1300** into system API commands and are provided to the adaptor **104** over the pocket- docking station bus **322** by serial ports **1308**, while data received from the applications **1200** for transmission is placed on the digital data signal lines **308** by the serial ports **1308**. Where the telephone **102** supports, for example, an Internet Protocol (IP) data stream, the data for transmission may simply be passed between the network comprised of the telephone **102**, data signal lines **308**, channel **1220** and server **1216**, and the local network that includes the application **1200**, and the signal lines **376** by the interface **348.** According to an embodiment of the present invention, the applications **1200** are configured to point to the interface **348** as their gateway. According to a further embodiment of the present invention, packets of data for transmission are addressed to a virtual data transmission data port and are thus recognized by the interface **348** as containing data for transmission over the wireless communications channel **1220**.

According to an embodiment of the present invention, a telephone **102** that does not provide IP framed data may be used in connection with applications **1200** that communicate using a TCP/IP protocol. For instance, the telephone **102** may be capable of sending and receiving data using a wireless application protocol (WAP) or other protocol. Such a telephone **102** may be capable of accessing certain web pages on the Internet that are formatted so that the information contained on the pages can be displayed by the display **114** of the telephone **102**. Furthermore, the displayed information may not be available as IP data from the electrical connector **116** provided on the telephone **102**.

However, signals representing the characters displayed by the telephone **102** may be available. In such instances, the interface **348** may packetize the raw data regarding the displayed characters and provide that raw data to an application **1200**. The reverse of this operation may also be performed to send information from an application to a server **1216**. Accordingly, the interface **348** may present a TCP/IP interface to an application **1200** even when the system **100** is used in connection with telephones **102** that provide a non-standard data stream.

With reference now to **Figs. 3**, **12** and **13**, communications channel control commands may be passed between an application **1200** running on an external subsystem **378** and the local network interface **1204** over the signal line **376** as TCP/IP type packet data. Furthermore, the commands are selected from a set of standardized control commands. According to an embodiment of the present invention, these standardized control commands are in the form of textual messages. The interface **348**, and in particular the processor **1300**, may be used to translate between the standardized control commands and the API of the system **100**, if they are different. The commands, formatted according to the API of the system are passed between the docking station **106** to the microprocessor **320** of the adaptor **104** by the pocket- docking station bus **322**. As will be described in greater detail below, the microprocessor **320** reformats the API command as required. In particular, the microprocessor **320** translates the commands between the API of the system and the set of commands used by the telephone **102**.

For example, the interface **348** may receive a command selected from a set of standardized communications channel control commands. The processor **1300** may then translate that command into a command or commands selected from a set of API control commands and formatted according to the API of the system. The command is then passed to the microprocessor **320**, which translates the command that has been formatted according to the API of the system **100** into a corresponding wireless communications device control command selected from the set of wireless communication device control commands used by the telephone **102**. In this way, the adaptor **104** and docking station **106** allow communications channel control commands formatted according to a general standard, such as one that allows an application **1200** to issue commands in the form of textual messages, to be reformatted so that they can be acted upon by a particular telephone **102**. Therefore, the translation function provided by the adaptor **104** removes the need for the applications **1200** to issue commands using the command set of the telephone **102** in order to control the operation of the telephone **102**.

With reference now to **Fig. 14**, the operation of a system **100** in accordance with an embodiment of the present invention is illustrated. In particular, **Fig. 14** illustrates the operation of an embodiment of the system **100** in connection with the receipt of data from an application **1200**.

Initially, at step **1400**, a data packet is received from an application **1200** at the docking station **106**. In particular, the data packet is received by the local network

interface **1204** and passed to the processor **1300**. The processor **1300** determines whether the received data packet is addressed to the virtual control data port or whether it contains data for transmission (step **1404**). If the data packet contains a communications channel control command, it is addressed to the logical or virtual control data port, formatted according to the API of the system by the interface **348** and directed to the microprocessor **320** of the adaptor **104** over the pocket- docking station control bus **322** (step **1408**). The microprocessor **320** receives the control command and generates a wireless communications device control command that is formatted according to the requirements of the telephone **102** (step **1412**). The telephone-specific command is then passed to the telephone **102** over the telephone control signal bus **314** (step **1416**).

If the data packet contains data for transmission, and if the telephone **102** can send and receive TCP/IP formatted data, the data is bridged from the local network that includes the application **1200** to the network that includes the telephone **102**, wireless communications channel **1220**, and server **1216** by the interface **348**. In crossing the interface, header information regarding the addressing of the data packets may be altered, but otherwise the data is passed to the telephone **102** directly. That is, the payload of the data packets remains unaltered by the interface **348**. The data for transmission is then communicated between the interface **348** and the telephone **102** by the digital data path signal lines **308**. Accordingly, in connection with data for transmission, the function of the adaptor **104** is to provide a physical interconnection between the telephone **102** and the

digital data path signal lines **308**. According to a further embodiment of the present invention, the data for transmission may be reformatted as a parallel bit stream before it is passed to the telephone **102**, for those telephones **102** that provide and receive a parallel bit stream at the electrical connector **116**. According to still another embodiment of the present invention, the data packets containing data for transmission are formatted as PPP or SLIP data packets.

With reference now to **Fig. 15**, the operation of a system **100** in accordance with an embodiment of the present invention in response to a request by an application **1200** for a communications channel **1220** is illustrated. Initially, at step **1500**, a local communications channel is established between the application **1200** and the docking station **106**. For example, the user of a laptop computer may establish a signal line **376a** by using a cable to interconnect the docking station **106** and the laptop computer **378**, thereby providing a physical channel for data to be passed between the application **1200** and the docking station **106**. Next, the application **1200** queries the interface **348** of the docking station **106** for information regarding the capabilities of the telephone **102** (step **1504**). It should be appreciated that the application **1200** used to request a communications channel **1220** may be specifically adapted to that purpose. Alternatively, a larger, general purpose application **1200**, such as a web browser or an e-mail application may be provided with the functionality required to request a communications channel **1220**, for example through a plug-in. As a further alternative, the user may enter

commands in a communication program, such as Telnet, available from Microsoft® Corporation, to request a communications channel. The docking station **106** then responds (step **1508**). The docking station **106** generally can respond to the query because it is provided with information regarding the telephone's capabilities from the adaptor **104**.

In particular, the adaptor **104** may be encoded with information regarding the telephone's capabilities, such as where the adaptor is configured for use with one or more telephones **102** having a common feature set. Alternatively, the telephone **102** may automatically provide identification information or information regarding its capabilities when it is placed in the adaptor **104**. The adaptor **104** may use this information to determine the set of wireless communications device control commands that must be used in order to interact with the telephone **102**, and to determine the capabilities of the telephone **102**. If the adaptor **104** is programed with information regarding the telephone **102** capabilities, or is provided with that information from the telephone **102** itself, queries concerning such information can be responded to by the docking station **106** using the information provided by the adaptor **104**, without passing the query on to the telephone **102**. Alternatively, if the docking station **106** cannot answer the query based on the information provided by the adaptor **104**, the query may be passed to the telephone **102** itself. The capabilities of the telephone **102** are returned to the application **1200** through the interface **348**. The capabilities of the telephone **102** determine, for example, whether

the application **1200** is required to provide a telephone number to the telephone **102** in order for a wireless communications channel **1220** to be established. In addition, the interface **348** must know how data for transmission by the phone should be formatted. For example, whether data should be sent as TCP/IP formatted data or formatted according to another protocol, such as PPP, SLIP, etc.

At step **1512**, the application **1200** requests a wireless data communications channel, and supplies any additional information required by the telephone **102** to the docking station **106**. Accordingly, the request may include providing the telephone **102** with a telephone number, a password, or simply commanding the telephone **102** to establish the wireless communications channel **1220.** The request may be issued by the application **1200** using a command selected from the set of textual messages that comprises the standardized command set used to communicate communications channel control commands between the application **1200** and the interface **348**. Because the data packet or packets used to communicate the request contain a communications channel control command, it will be addressed to the data control port of the data daughter board **380**. The docking station **106** recognizes that the data packet contains a communications channel control command because it is addressed to the control data port of the interface **348**. Accordingly, the docking station **106** translates the request into one or more messages according to the API of the system and passes the command to the adaptor **104** over the pocket- docking station communications bus **322** (step **1516**).

The adaptor **104** receives the request formatted according to the system protocol (*e.g.*, the API of the system **100**), translates the request into one or more wireless communications device specific commands and passes the commands to the telephone **102** (step **1520**). For example, the command to access or establish a communications channel **1220** may include a command to dial a number specified by the application **1200**, the adaptor **104**, or the docking station **106**. In response to such a command, the adaptor **104** must provide the telephone **102** with electrical signals at the correct pins of the electrical connector **116** and in the correct sequence in order to simulate entry of the number using the keypad **112** of the telephone **102**. The reformatted request is provided to the telephone **102** over the telephone control signal bus **314**. Accordingly, the adaptor **104** provides the request using commands selected from the set of wireless communications device control commands understood by the telephone **102** and in the format required by the telephone **102**, in addition to providing the electrical connector required to deliver the request to the telephone **102**.

The telephone **102**, in response to the request, establishes a communications channel **1220** with the base station or server **1216** (step **1524**). How the telephone **102** establishes the communications channel **1220** depends on the particular telephone **102**. For example, a telephone **102** having a dedicated data transmission channel may simply perform the steps necessary to activate that channel. Alternatively, the telephone **102** may be directed to a server or base station **1216** specified by the application **1200**. For

example, the request to establish a communications channel **1220** may include a direction to the telephone **102** to dial a specified telephone number and ready itself for data transmission. It should be appreciated that the request to establish a communications channel **1220** may be communicated by providing the telephone **102** with a series of commands. For example, the telephone **102** may be provided with each digit of a telephone number serially, followed by a command to dial.

As a further example, the command from the application **1200** to access or establish a communications channel **1220** may contain no specific information regarding the gateway or server **1216** with which the channel **1220** is to be established. In such instances, the adaptor **104** or the docking station **106** may provide a previously stored telephone number to be dialed. If the telephone **102** is capable of establishing a communication channel **1220** for transmitting data without using a dial up connection, the command that is provided to the telephone **102** need only comprise an instruction to establish the communications channel **1220**. If a request for a communications channel **1220** is received from a second application **1200b** after the communication channel **1220** has already been established by, for example, a first application **1200a**, the request does not need to be provided to the telephone **102**. Instead, the docking station **106** may recognize that a channel **1220** has already been established and may provide a signal to the application **1200b** indicating that the channel **1220** is available.

In general, the telephone **102** will provide a signal indicating that the communications channel **1220** has been established and is ready to transmit data. The telephone **102** issues this signal using the protocol determined by the manufacturer of the particular telephone **102** (*i.e.* using a wireless communications device control command). Accordingly, the confirmation of channel availability may be provided as a serial or parallel bit stream that encodes information regarding the available channel **1220**. Alternatively, the availability of a channel **1220** may be signaled by changing the voltage at a single contact of the electrical connector **116**. Regardless of how the telephone **102** signals the availability of the channel **1220**, the signal is received by the adaptor **104** and is translated and reformatted to comply with the API of the system **100**. The translated and reformatted signal is then passed to the docking station **106** (step **1528**). The docking station **106**, according to the present example, translates the API message into a textual message according to the set of wireless communications channel control commands, formats it as a TCP/IP data packet and passes it to the application **1200** (step **1532**).

After the availability of the channel has been communicated to the application **1200**, data may be sent and received from the application **1200** used to establish the wireless communications channel **1220** (step **1536**). Alternatively, the application **1200** used to establish the wireless communications channel **1220** may exit, and any Internet aware application **1200** may communicate over the wireless communications channel **1220** in a normal fashion. The data that is passed between the server **1216** and the application

1200 is generally not reformatted by the adaptor **104**. Instead, the data for transmission, which is formatted according to a universal protocol, such as TCP/IP, is supplied directly to the telephone **102** from the application **1200** as a serial bit stream. However, when required by the telephone **102**, the serial TCP/IP data stream from the application **1200** is reformatted. For instance, the data may be presented to the telephone **102** as a parallel bit stream, or reformatted according to the PPP, SLIP or some other protocol.

With reference now to **Fig. 16**, the operation of a system **100** in accordance with an embodiment of the present invention is illustrated in the context of an example. For purposes of this example, it will be assumed that the system **100** is installed in an automobile **302**. According to this example, the external subsystem **378a** is a first laptop computer, external subsystem **378b** is a second laptop computer, external subsystem **378c** is a PDA, application 1 **1200a** initially represents an application used to establish a wireless communication channel **1220** and later represents a standard web browser, as explained below. Application **1200c** initially represents an application used to establish a wireless communications channel **1220**, and later represents a standard e-mail program, as explained below. Initially, at step **1600**, user 1 attaches her laptop computer **378a** to a local network interface **1204** port **1208a** provided on the docking station **106** using a cable, thereby establishing a signal line **376a**. For purposes of the present example, the local network interface **1204** can be assumed to include an Ethernet network card, and it will be assumed that the laptop computer **378a** is also equipped with an Ethernet network

card. The cable **376a** connecting the Ethernet port of the hub **1210** to the Ethernet port of the laptop computer **378a** is an Ethernet cable having connectors for interfacing with mating connectors on the network cards and/or hub.

After completing the hardware connection with the docking station **106**, user 1 activates an application **1200a** on her laptop computer **378a** to establish a data connection with the telephone **102** (step **1604**), as described above in connection with steps **1504-1524** of **Fig. 15**.

After receiving an indication that the telephone **102** has established a wireless communications channel **1220**, the initial application **1200a** used to establish the wireless communications channel **1220** exits, and user 1 activates a web browser **1200a** to access Internet web sites in a normal fashion (step **1608**).

At step **1612**, user 2 establishes a Bluetooth wireless network connection between a PDA **378c** and the docking station **106**. User 2 then activates an application **1200c** to establish a data connection with the telephone **102** (step **1616**). The application **1200c** queries the docking station **106**, and is informed that a data connection is already established. The application **1200c** used to establish the data connection then exits, and user 2 activates a mail application **1200c** to retrieve and read e-mail messages from the Internet (step **1620**).

User 3 then interconnects a second laptop **378b** to a second network port **1208b** on the docking station **106**. User 3, knowing that user 1 has already established a data

connection, activates a web browser **1200b** on a second laptop **378b** without first running a separate application to establish a data connection (step **1624**). Accordingly, it can be appreciated that the docking station **106** functions as an Internet gateway to any Internet aware application **1200** that is in communication with the docking station **106**.

From the above example, it can also be appreciated that multiple devices may share a communications channel **1220** established by the system **100**. In particular, data packets addressed to different devices and servers may be transmitted across the communications channel **1220** at substantially the same time.

Although the examples set forth above are in the context of communications initiated by external devices **378**, it should be appreciated that communications can also be initiated by devices or applications that are at the server **1216** side of the channel **1220**. In such instances, data addressed to a particular device **378** or application may be routed from the telephone **102** to the receiving device **378** or application **1200**. Of course, any required translation of the data format, such as from a parallel bit stream to a serial bit stream, may be performed in the adaptor **104**.

Although the examples described above involve a system API having a format and command set that are different from those of the wireless communications channel control commands, this is not necessarily the case. For instance, according to one embodiment of the present invention, the API used to communicate control commands between the interface **348** and the adaptor **104** may include as valid commands the set of textual

messages included as part of the set of wireless communication channel control commands. According to such an embodiment of the present invention, no translation of commands must be performed by the interface **348**, although reformatting of the command data may still be required.

In accordance with the present invention, a method and apparatus for wireless communications are provided. The invention in its broader aspects relates to an economical method and apparatus for providing various levels of hands-free functionality in combination with wireless communications devices. In particular, the present invention provides a method and apparatus allowing for a wide variety of telephones and pockets to be used with a common docking station, and in connection with multiple external devices.

The foregoing discussion of the invention has been presented for purposes of illustration and description. Further, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, within the skill and knowledge of the relevant art, are within the scope of the present invention. The embodiments described hereinabove are further intended to explain the best mode presently known of practicing the invention and to enable others skilled in the art to utilize the invention in such or in other embodiments and with various modifications required by their particular application or use of the invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.